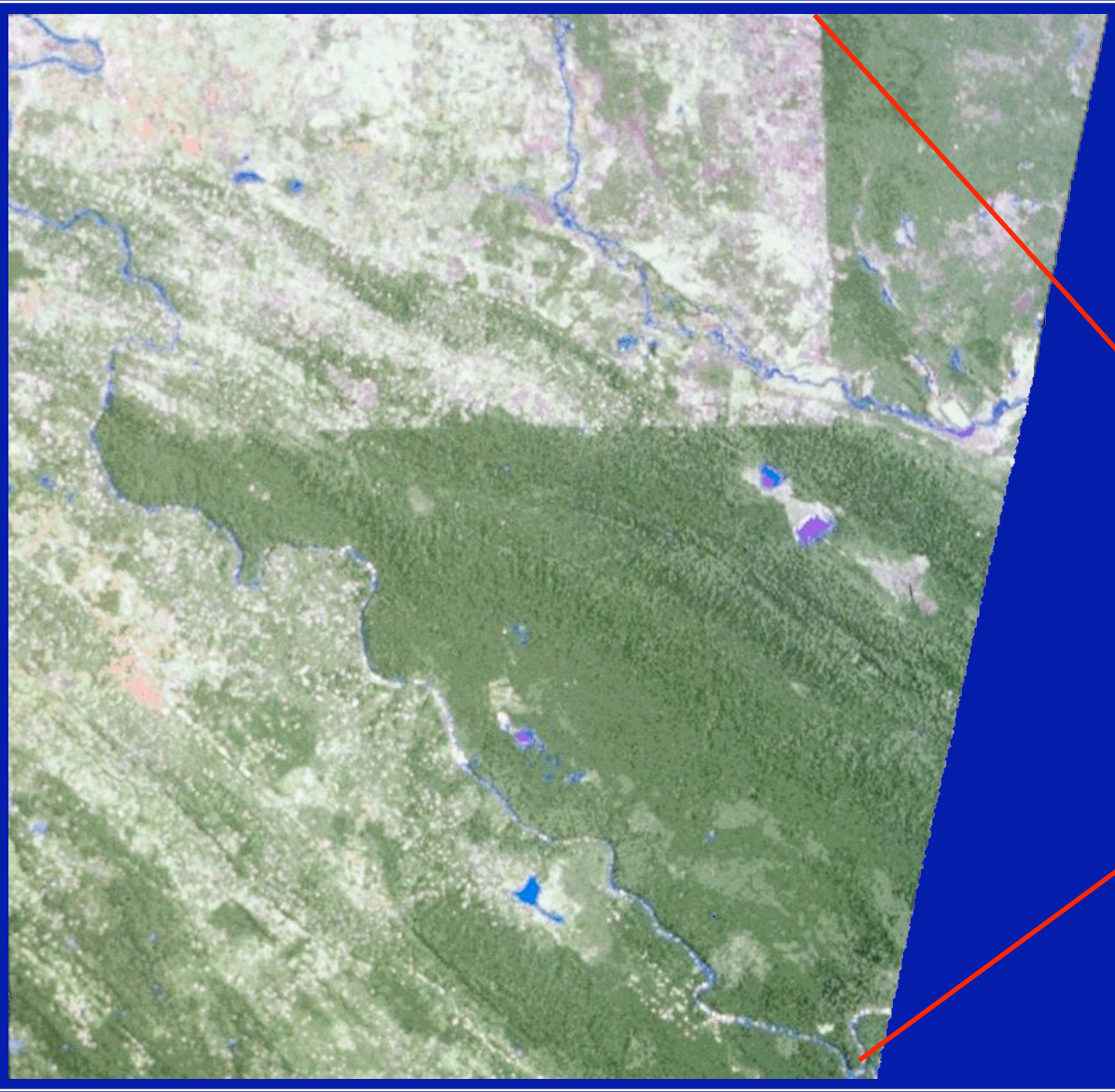

SERVIR
An Environmental Monitoring and Decision Support System for Mesoamerica
NASA
UAH
The University of Alabama in Huntsville
USAID
CATHALAC
anam

Primary SERVIR Team Institutions

- **REASoN Team**
  - **NASA/MSFC**
  - **University of Alabama at Huntsville**
  - **Science Systems and Applications Inc.**
- **USAID**
- **World Bank**
- **Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC)**
- **Central American Commission for Environment and Development (CCAD)**
- **University of Arkansas**
- **Oak Ridge National Laboratory**

Border of Mexico and Guatemala 1986

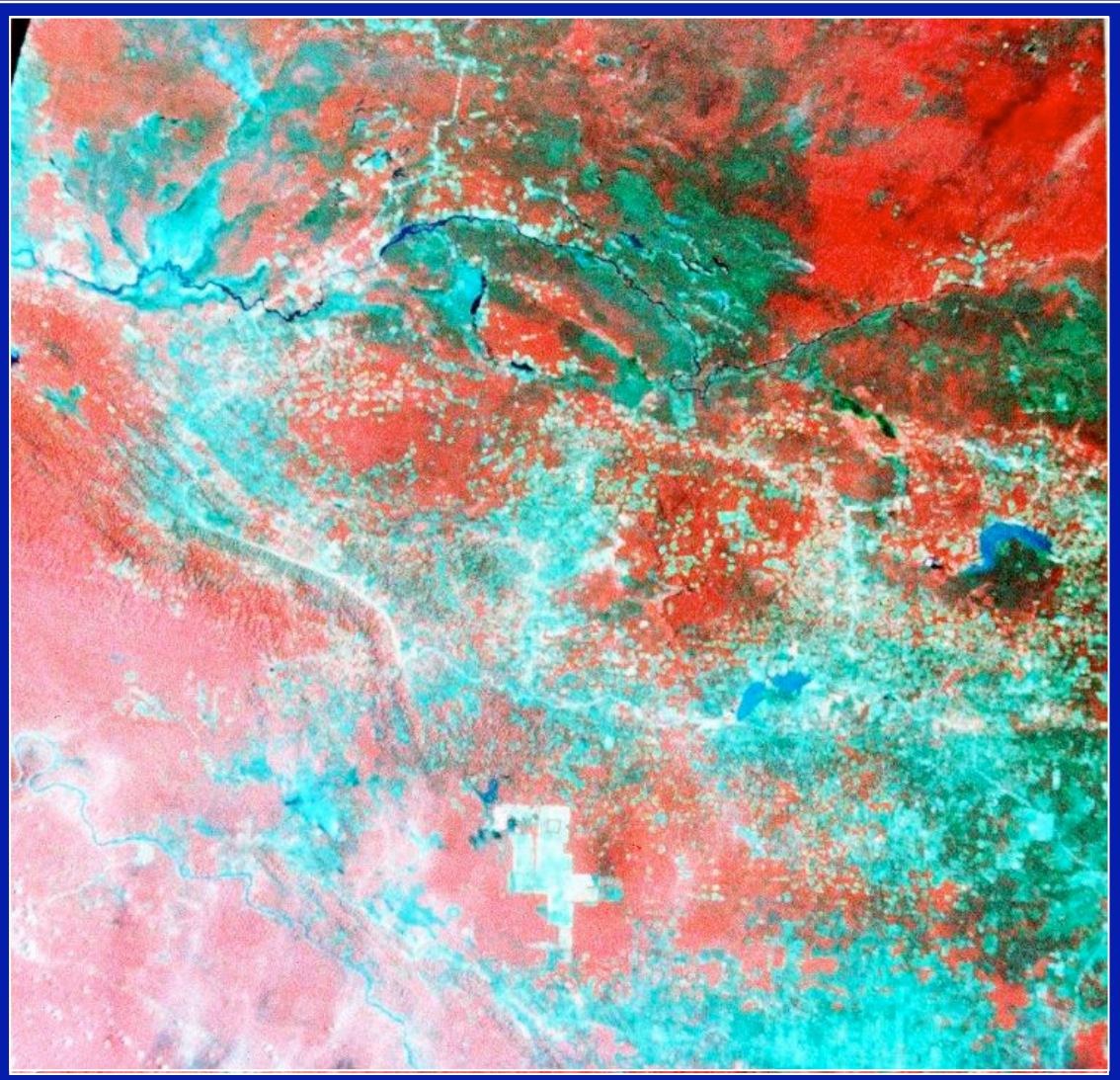


Presidential Handshake: Mexico - Guatemala

President Cerezo (Guatemala) President Salinas (Mexico)

Land Cover and Land Use Change

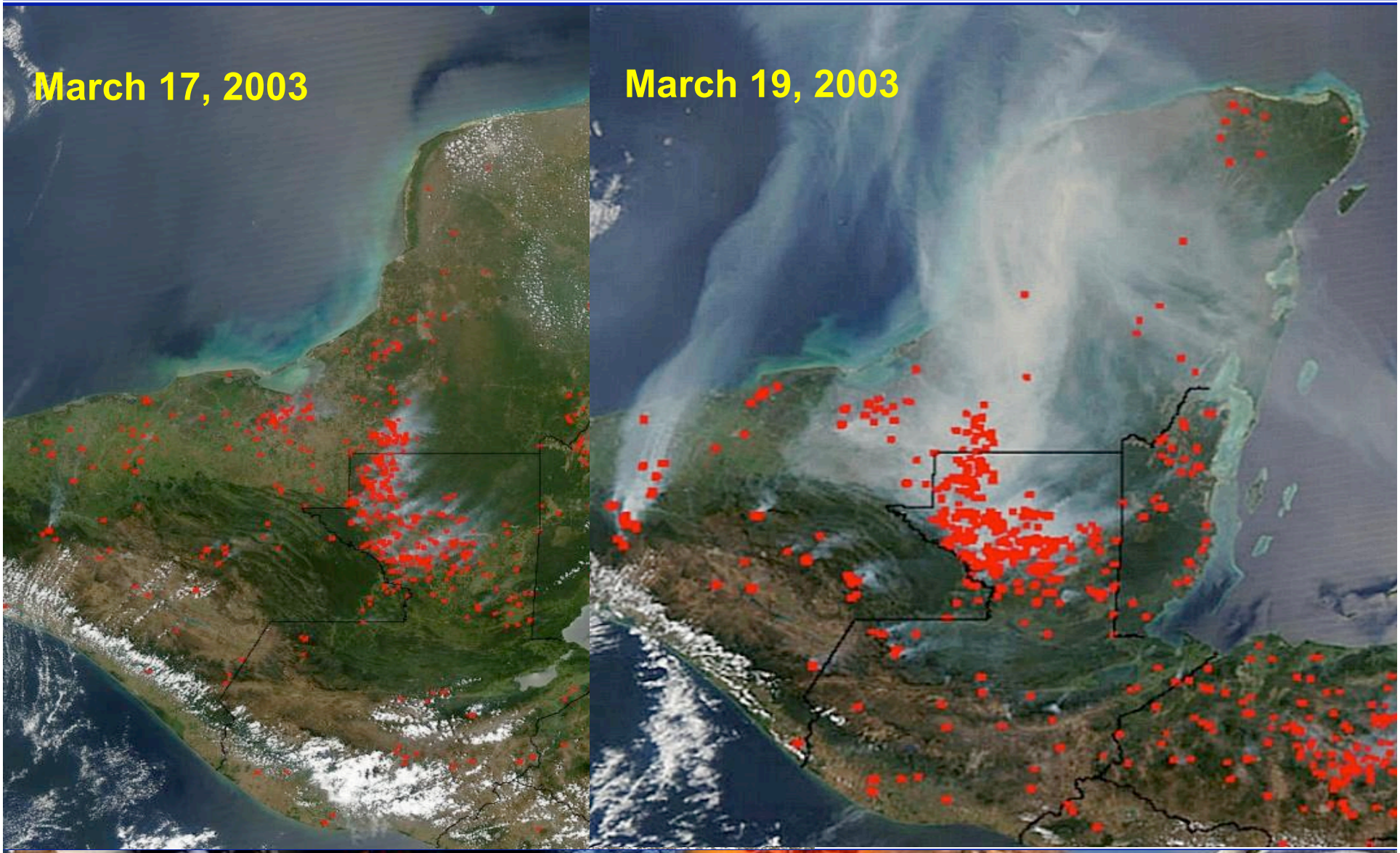
- **Conservation & Preservation**
- **Transportation Infrastructure**
- **- Urban Growth Planning**
- **- Human Impacts on the Land**
- **- Infrastructure and Utilities**



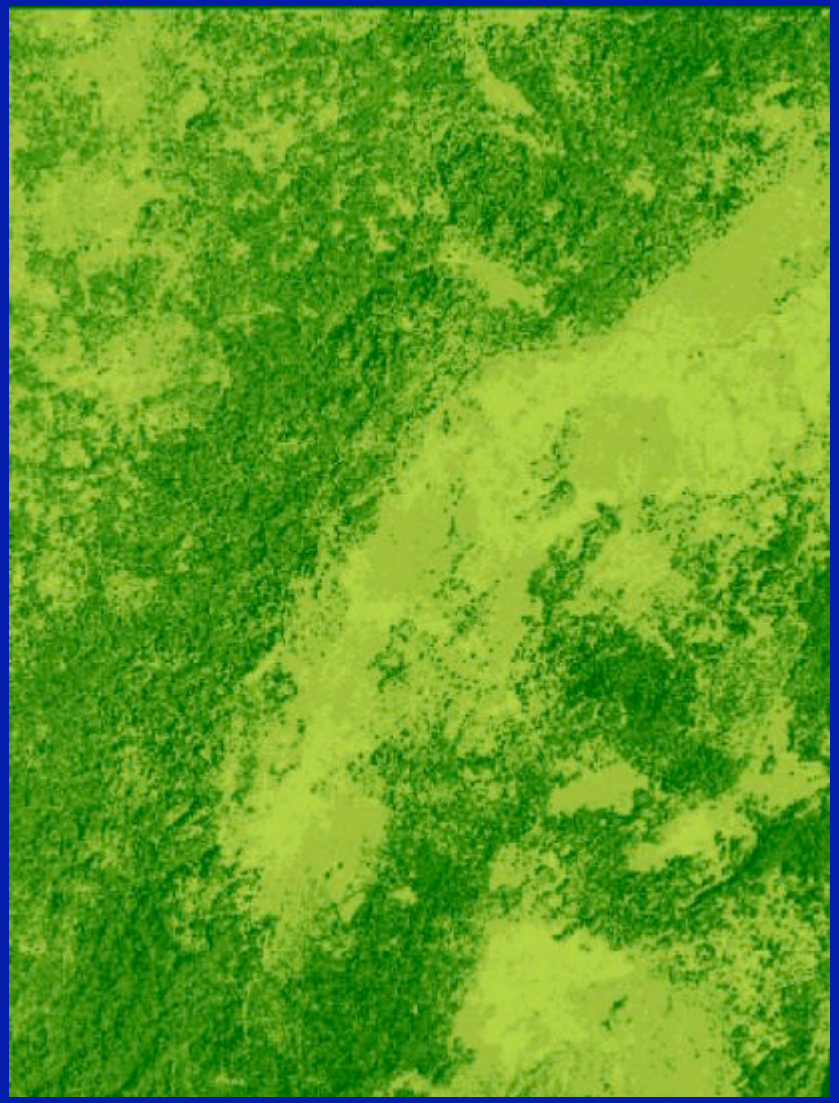
Peten, Guatemala (1986-1995)

Fires Time Lapse Sept 2001 – Aug 2002

MODIS Rapid Response Fires - March 2003



Model of Deforestation Following Road Building

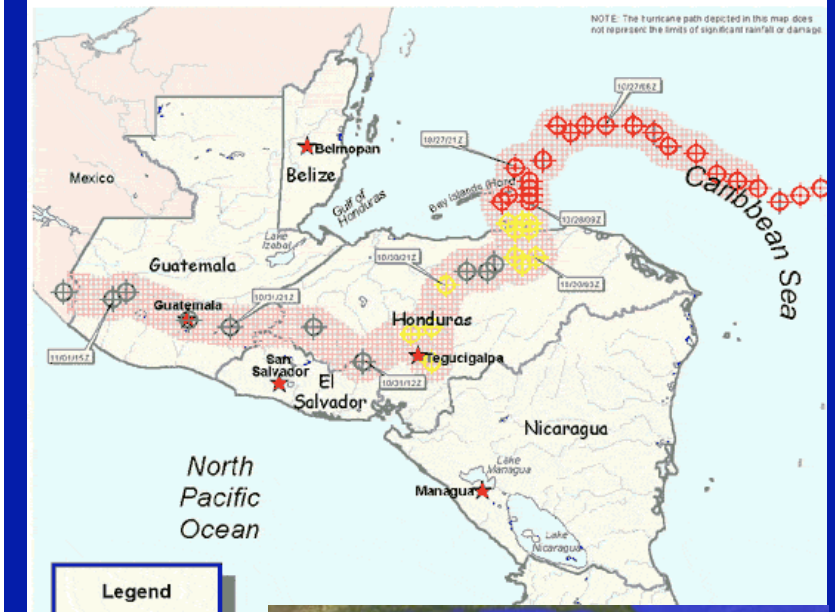


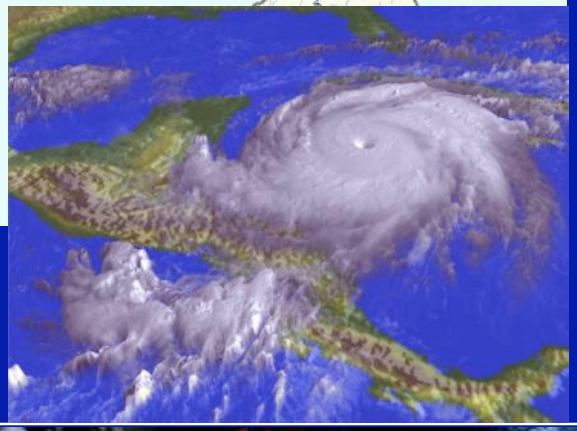
Natural Disasters – Hurricanes (Mitch 1998)

Track of Hurricane Mitch

From October 26 to November 1, 1998

USAID





GUATEMALA

Human Toll
258 Deaths
120 Missing
105,700 Affected

Infrastructure Damage
98 Bridges Destroyed
60% of Roads Impacted

HONDURAS

Human Toll
6,600 Deaths
8,052 Missing
2,100,000 Affected

Infrastructure Damage
170 Bridges Destroyed
70% of Roads Impacted

EL SALVADOR

Human Toll
239 Deaths
135 Missing
84,000 Affected

Infrastructure Damage
17 Bridges Destroyed
20% of Roads Impacted

NICARAGUA

Human Toll
2,055 Deaths
1,084 Missing
868,000 Affected

Infrastructure Damage
71 Bridges Destroyed
70% of Roads Impacted

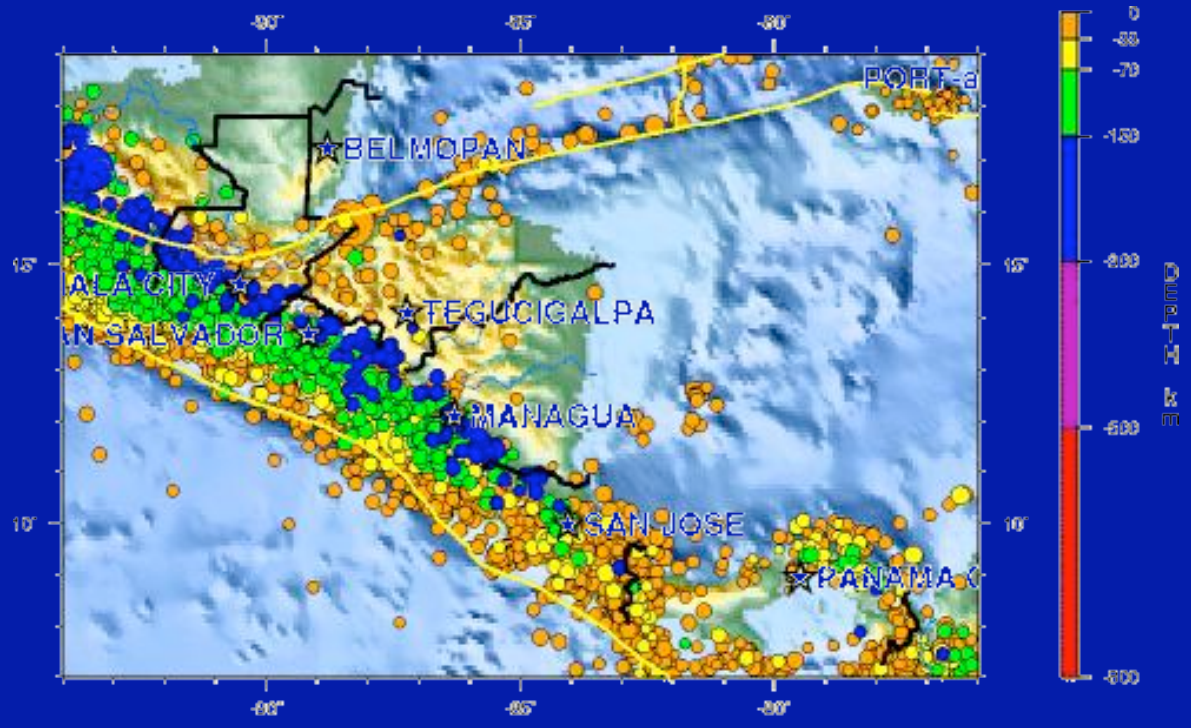
Impacts on Agriculture

Nicaragua - 30% of Banana Crop Destroyed
Guatemala - 45-60% of Corn Crop Destroyed
Honduras - 90% of Banana Crop Destroyed

Sources:
Deaths and Missing from Official Government Sources. Compiled by OFDA
Affected Population from UN Office of the Coordination of Humanitarian Affairs (OCHA)
Infrastructure and Agriculture from U.S. Southern Command (SOUTHCOM)
Produced November 20, 1998

OFDA

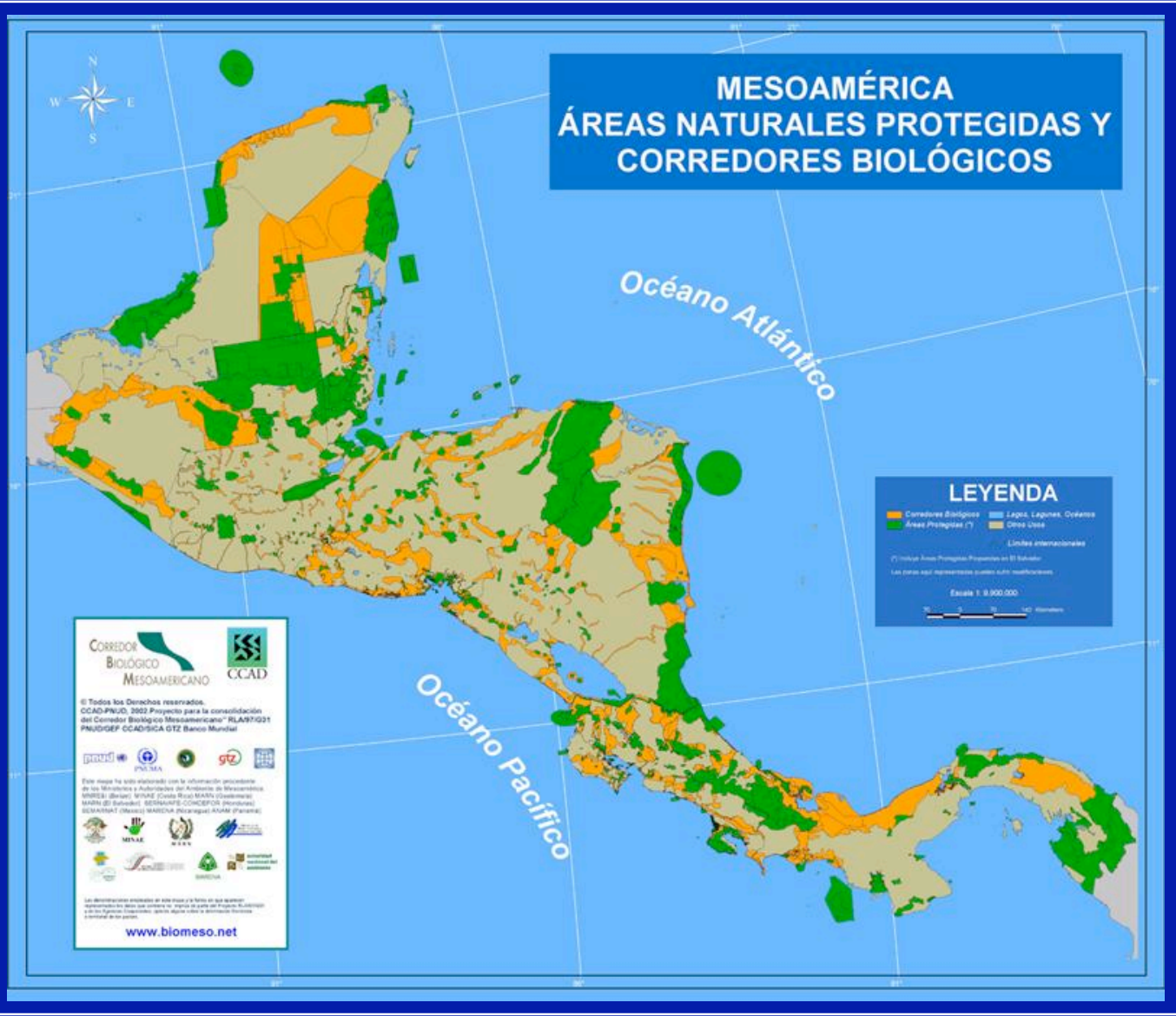
Natural Hazards – Earthquakes



Seismicity of Central America, 1990 - 2000

Natural Hazards - Volcanoes

The Mesoamerican Biological Corridor (MBC)



The MBC covers less than 1% of Earth's landmass, but contains 7- 8% of world's plant and animal species

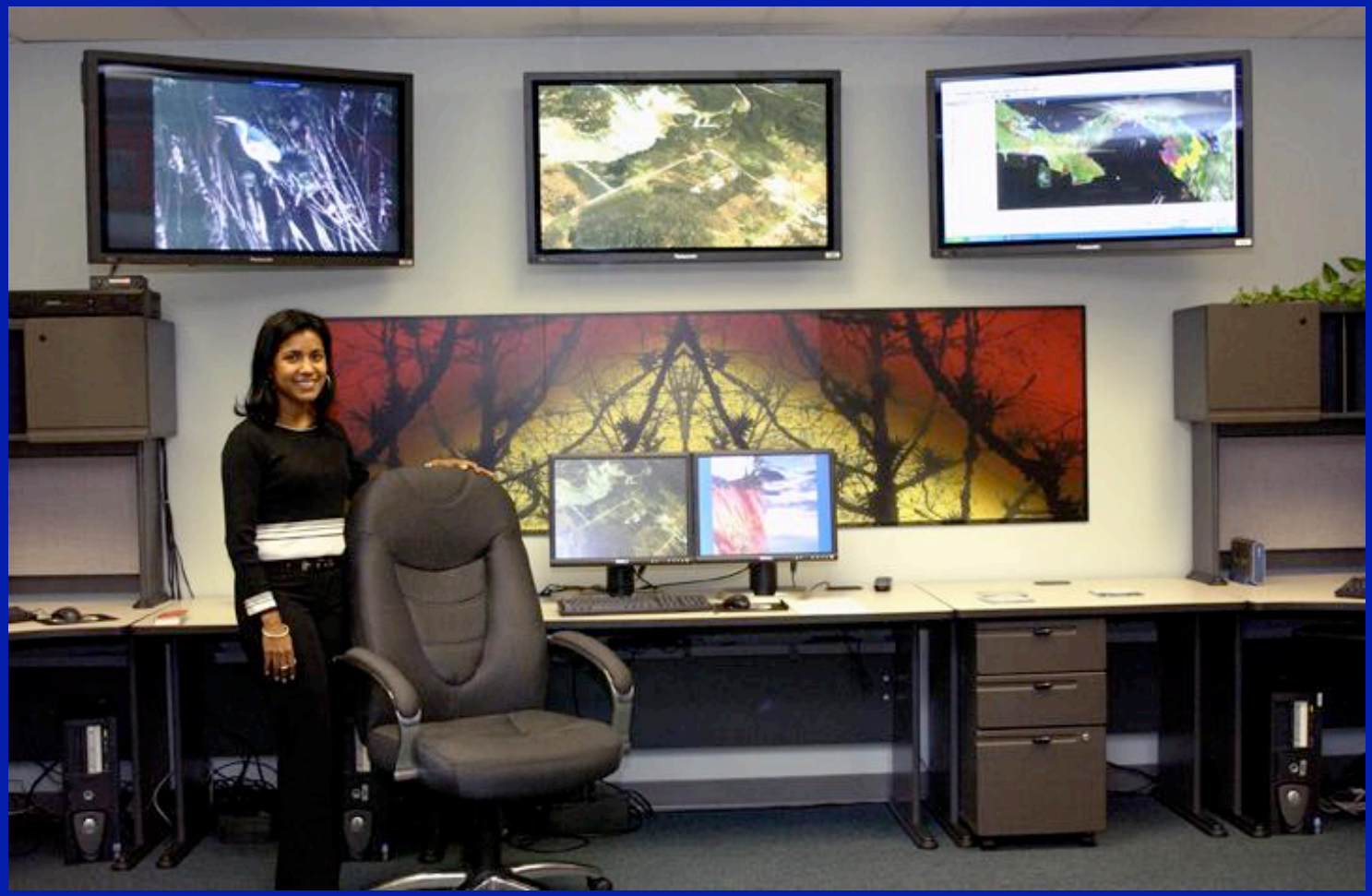
Population and Size

Country	Population (July 2001 est.)	Area (sq mi)
• Belize	256,062	8,865
• Costa Rica	3,773,057	19,730
• El Salvador	6,237,662	8,124
• Guatemala	12,974,361	42,043
• Honduras	6,406,052	43,278
• Nicaragua	4,918,393	49,998
• Panama	2,845,647	30,193
• TOTAL	37,384,234	202,231

SERVIR Concept Drawing - 2003

- Fire Detection
- Land Cover/Land Use
- Forest Monitoring
- Red Tides
- Climate Change
- Short Term Weather
- Drought Monitoring
- Inter. Scientific Research
- Carbon Flux
- Hot Spot Monitoring
- Disaster Mitigation
- Urban Studies

SERVIR Laboratory – NSSTC Oct. 2004



SERVIR Lab - National Space Science and Technology Center Huntsville Alabama

SERVIR Lab in Panama

SERVIR Lab – Panama Before

SERVIR Lab in Panama - After

SERVIR Dedication – February 3, 2005

SERVIR Dedication – February 3, 2005

SERVIR Main and National Nodes

NASA/MSFC
(Development)

SERVIR

CATHALAC/Panama
(Operational)

National Node — BELIZE
National Node — COSTA RICA
National Node — EL SALVADOR
National Node — GUATEMALA
National Node — HONDURAS
National Node — NICARAGUA
National Node — PANAMA
MEXICO (Observer)

National Nodes Located At Environmental Ministries of Mesoamerican Countries

National Node

PUBLIC INSTITUTIONS

- Geography/Mapping
- Climate/Meteorology/Hydrology
- Biodiversity (Forest, Protected Areas)
- Agriculture
- Disaster Prevention
- Other

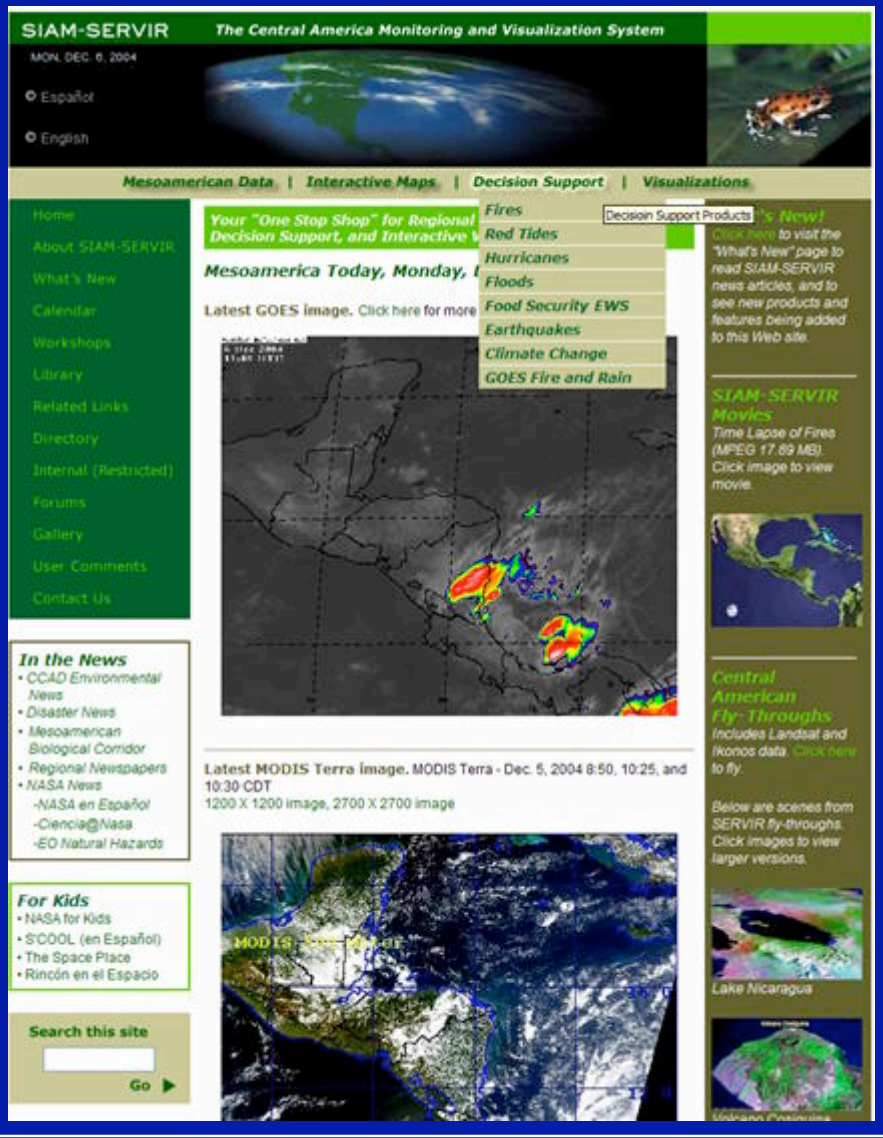
UNIVERSITIES & NON-GOVERNMENTAL

- Research/Educational
- Conservation
- Other

PRIVATE SECTOR

- Hydroelectric
- Aviation
- Other

SERVIR Web Page http://servir.nsstc.nasa.gov



- **Fully Operational on February 1, 2005**
- **Four Main Sections**
  1. **Mesoamerican Data**
  2. **Interactive Maps**
  3. **Decision Support**
  4. **Visualizations**

SERVIR NSSTC Node - Data Flow

Earth Observatories

Electronic Transfer

SERVIR Node @ NSSTC

(NASA/MSFC and U. Alabama in Huntsville)

Product Generation System
- Ingest Data
- Subset Data Over C. Amer.
- Mine Data for Events
- Generate Products

Web Server
servir.nsstc.nasa.gov
- Distribute Products
- Archive Products

Visualization System

Source Data Archive

Product Archive

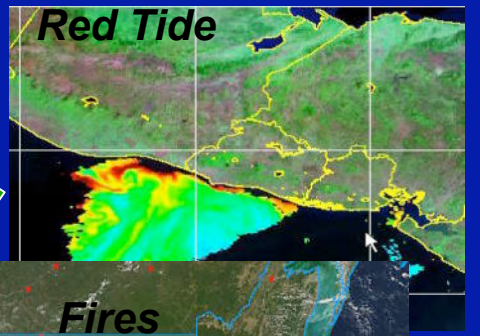
Data & Algorithms

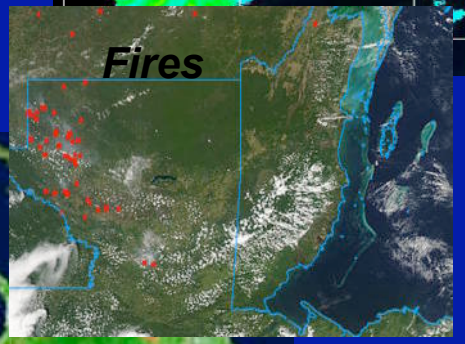
SERVIR Partners

Decision Makers - Researchers

- Emergency Responders
- Environmental Managers
- Political Leaders
- Researchers, Educators

Environmental Monitoring & Decision Support Products





Rapid Response
ftp, e-mail, etc.

SERVIR Node in Panama

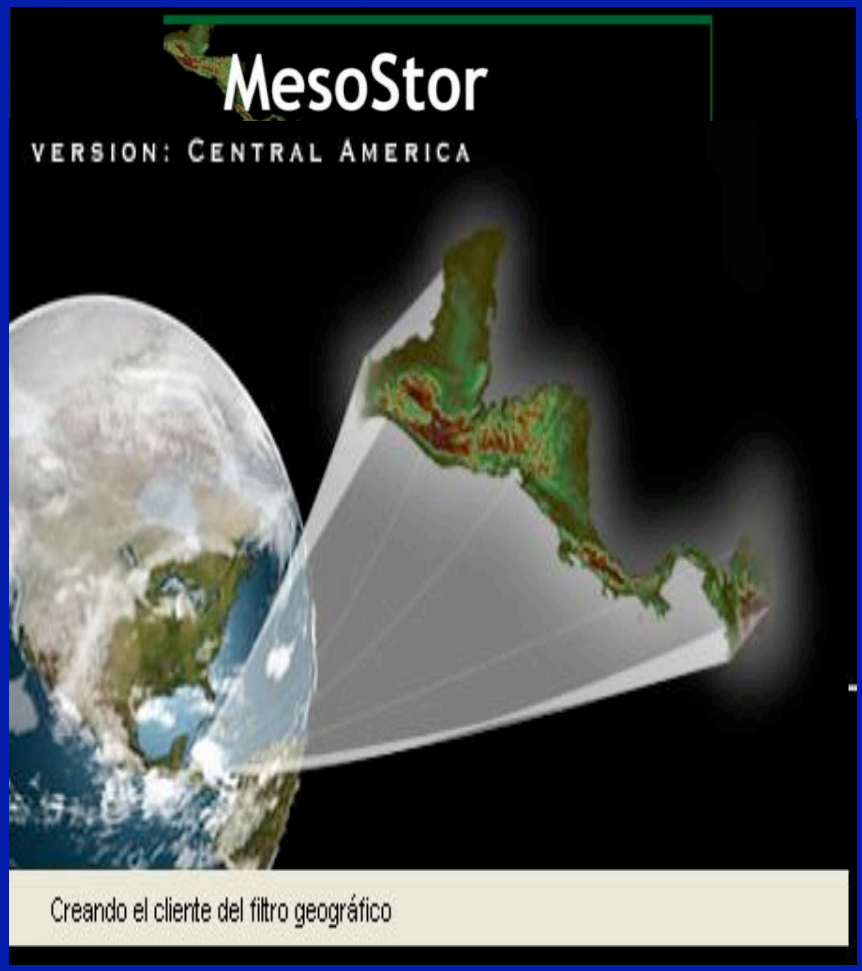
- Geographic Info Systems
- Decision Support Systems
- Environmental Data from Central American countries

Goals

- Rapid Response
- Corridor Preservation
- Species Preservation
- Sustained Development
- Better Living Conditions
- Policy Changes

Panama Node Regional Data System

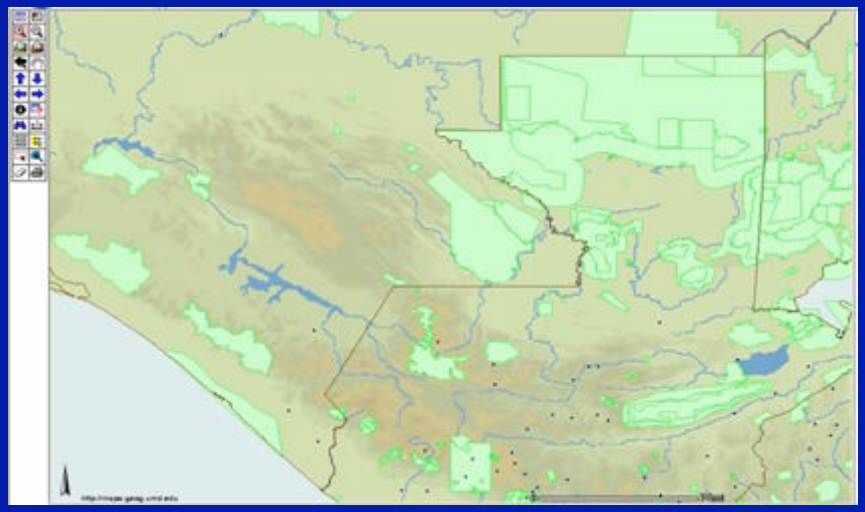
- **A one-stop geospatial data store**
- **Working in Beta as of October 2004**
- **A seamless database of vector and raster data covering all of Mesoamerica**
- **Web-based system for selection and delivery of geospatial data**

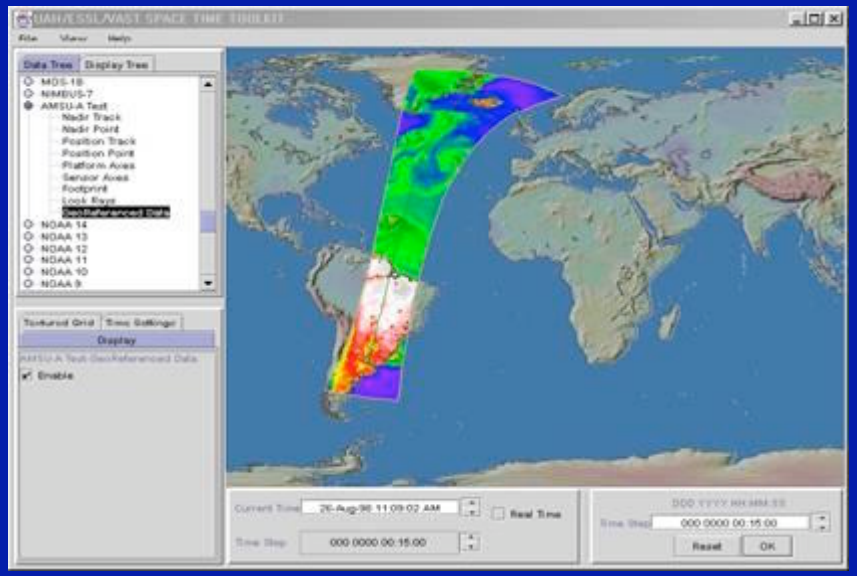


Data Systems – Web Services

Interactive On-Line Maps

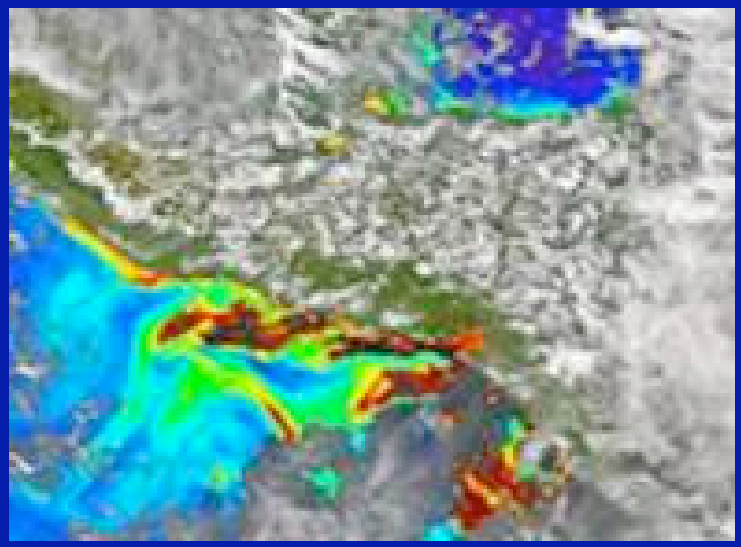
- **Mapping for the "Casual User"**
- **Web Map Server at regional node**
- **Multiviewer client**
- **Specialized clients (UAH-Space Time Toolkit)**
- **Thematic Areas – Biological, Protected Areas, etc.**
- **User Friendly Thematic Queries**





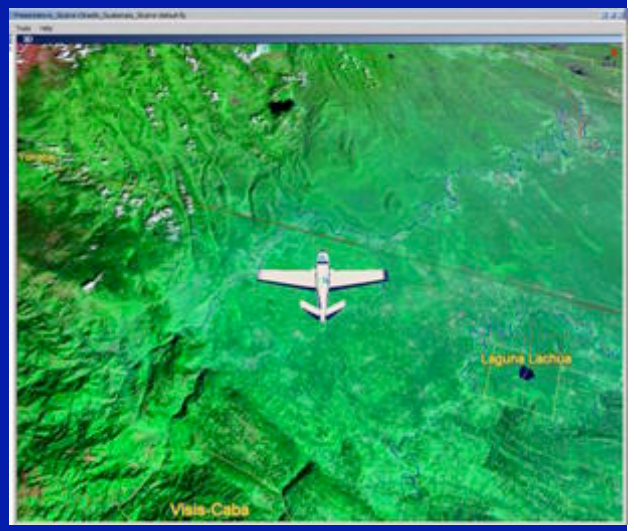
Decision Support Tools

- **Fires**
  - **MODIS Rapid Response**
  - **Web Fire Mapper (UMD)**
  - **Fire Alerts (Pilot)**
- **Red Tides (Harmful Algae Blooms)**
- **Climate Change Scenarios**
- **Short Term Weather Prediction (SPORT)**
- **Land Cover and Land Use Change for Carbon Management**
- **Floods**
- **Other**

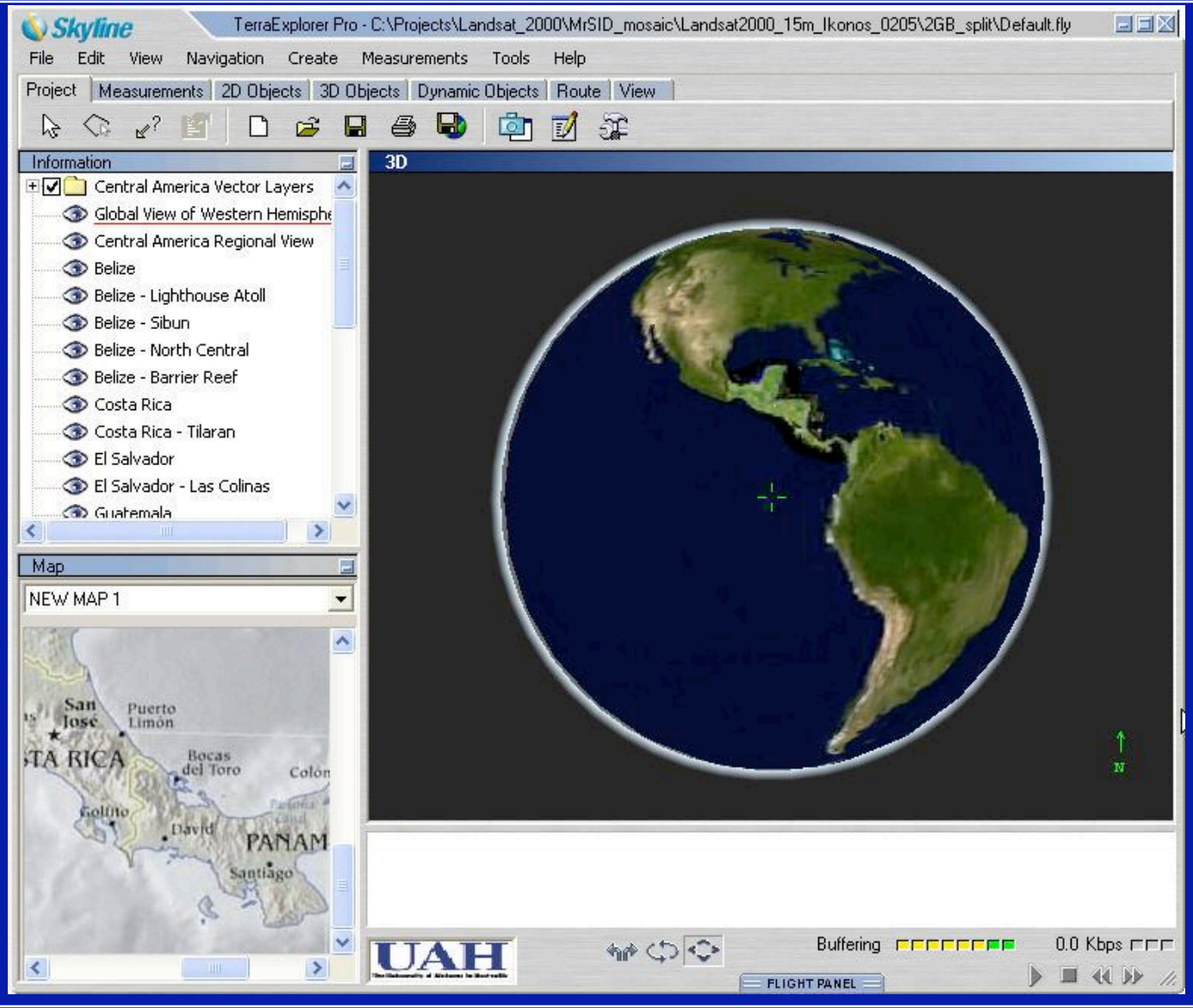


Visualization Tools for Decision Support

- **NASA and COTS**
  - **World Wind - NASA**
  - **Terra Builder & Terra Explorer Pro – Skyline Software Corporation**
  - **ERDAS Imagine**
- **Users**
  - **Decision Makers**
  - **Media**
  - **Educators**
  - **Students**

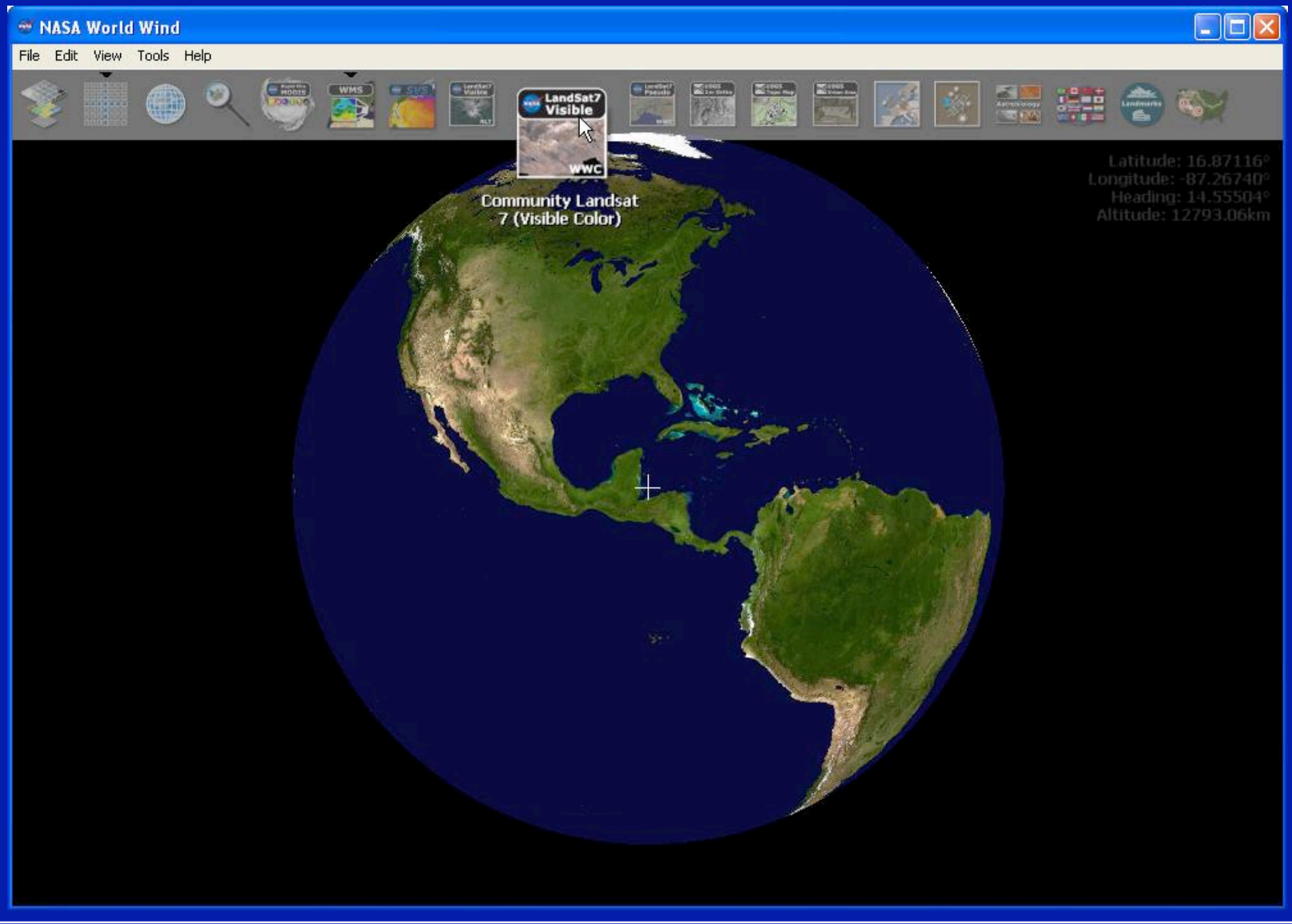


Terra Explorer Pro 4.6 User Interface

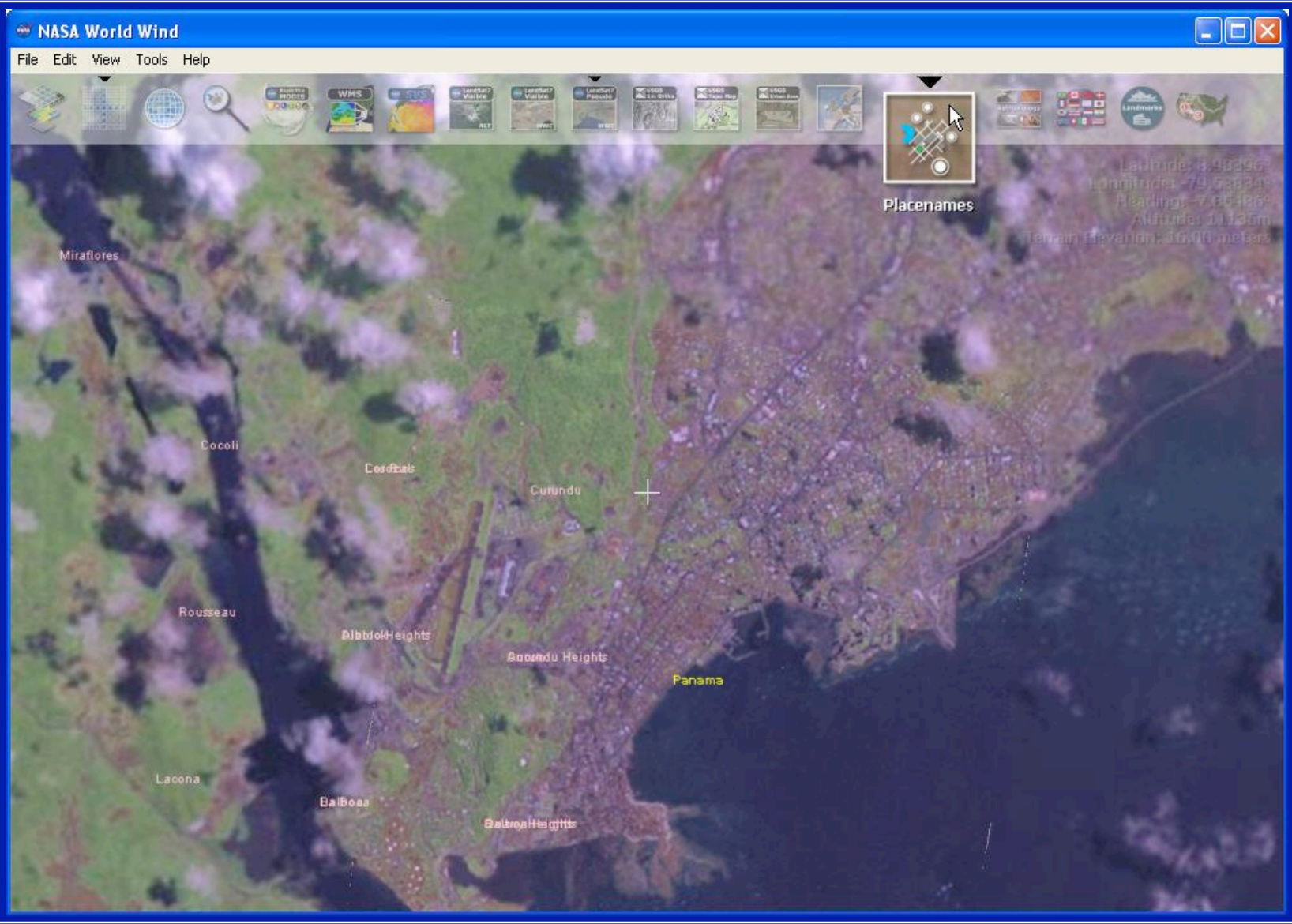


Panama Canal Flight

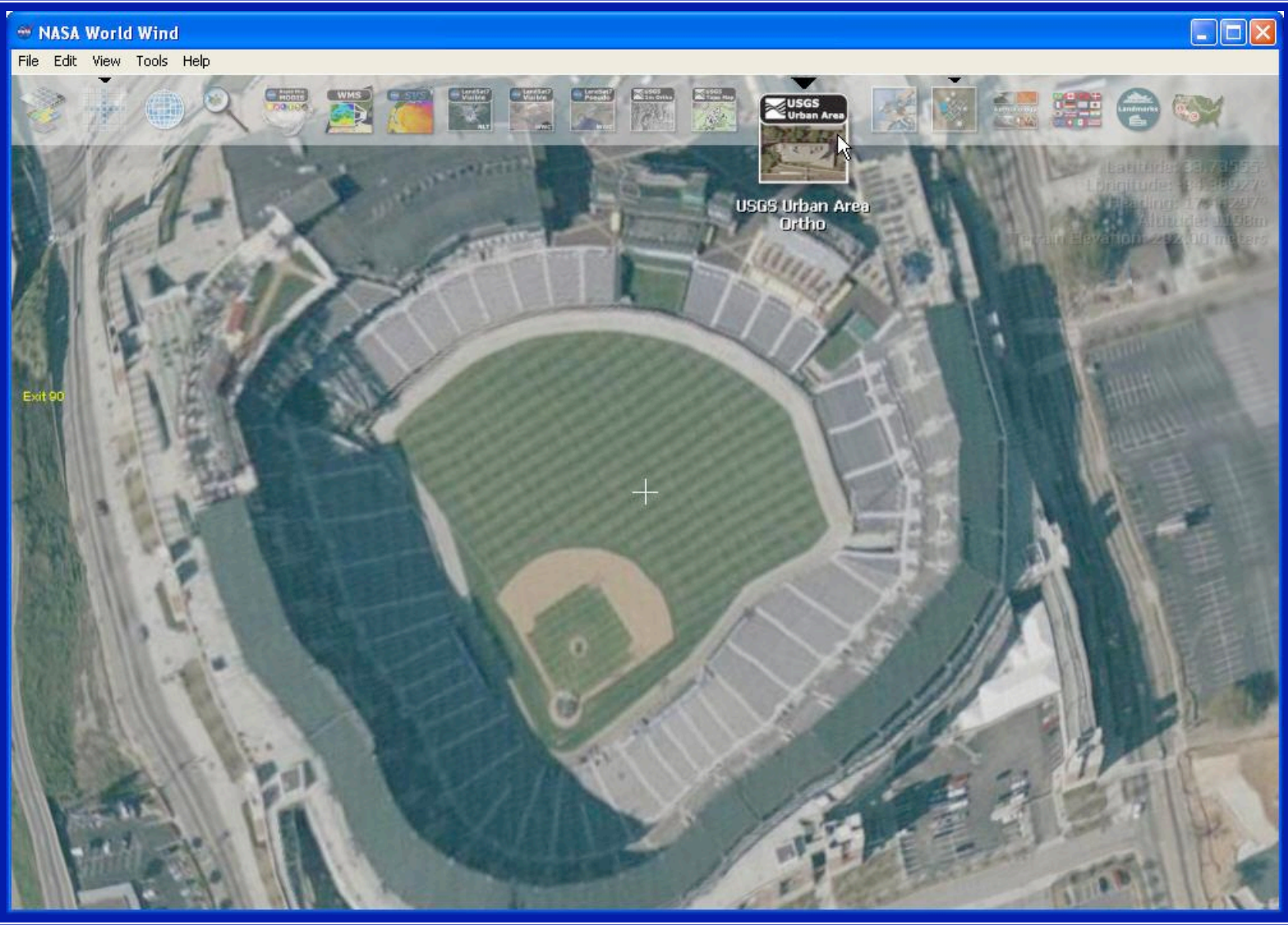
NASA World Wind



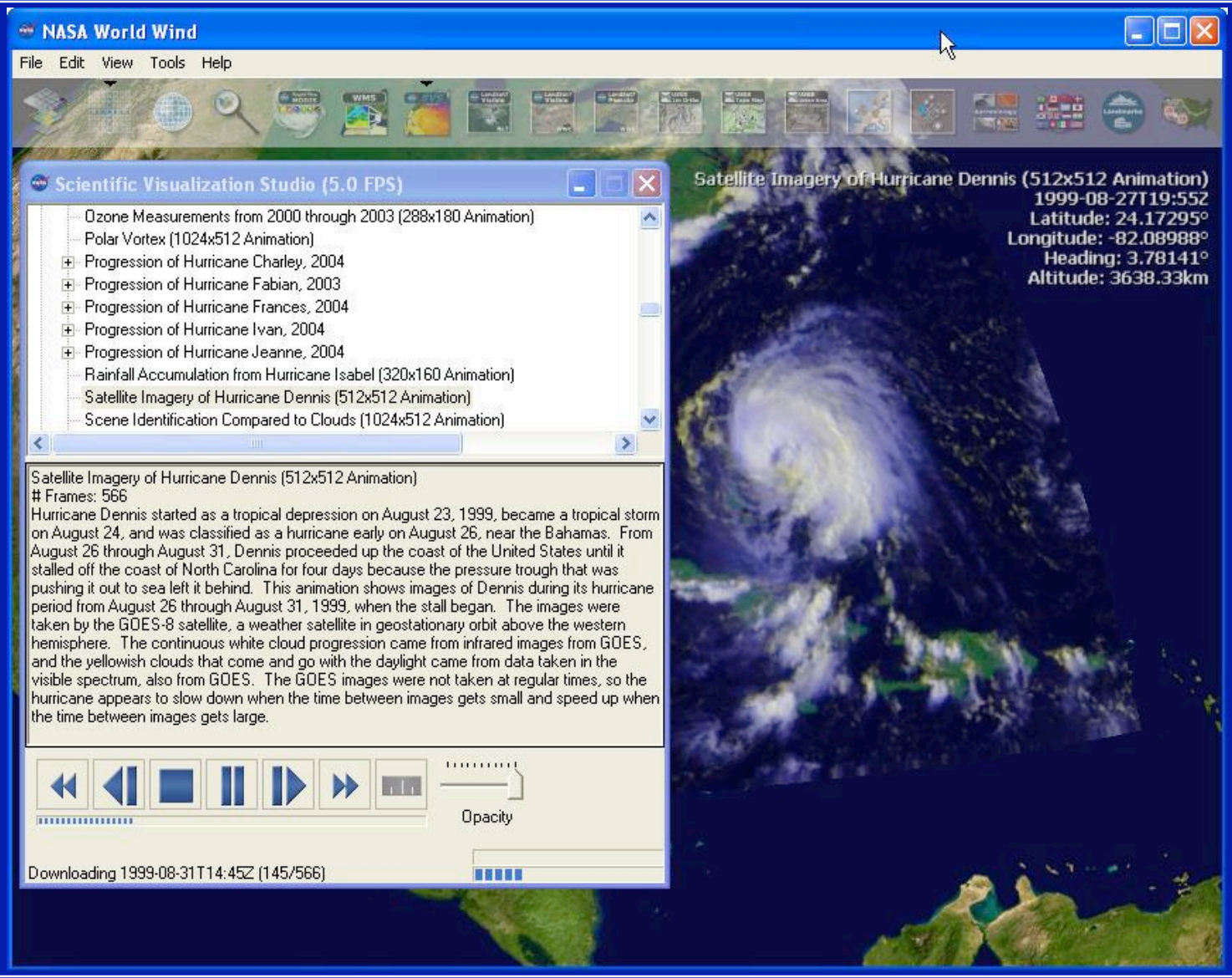
NASA World Wind – Landsat Imagery of Panama



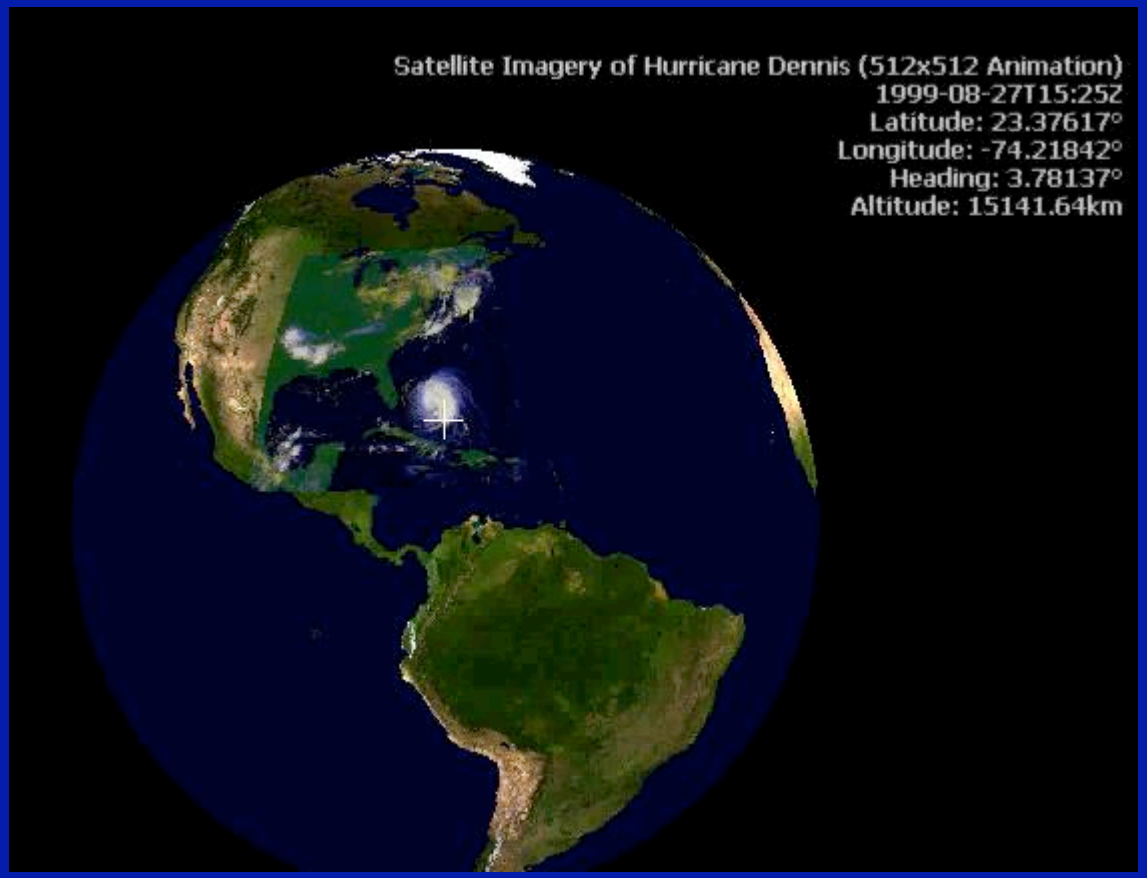
NASA World Wind – Urban Ortho Photo Turner Field



NASA World Wind – Animation Over 3-D Earth

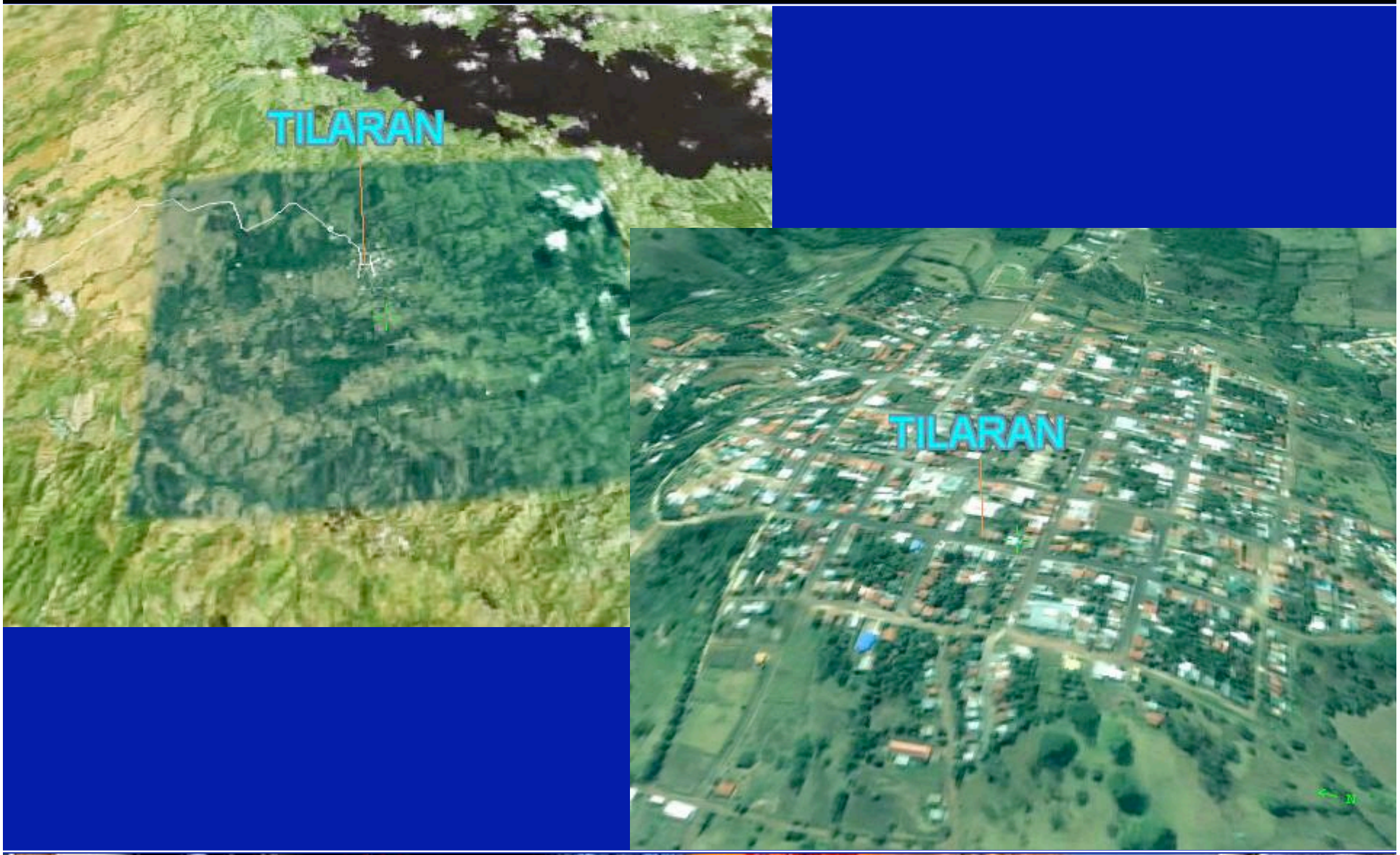


NASA World Wind – Animation File

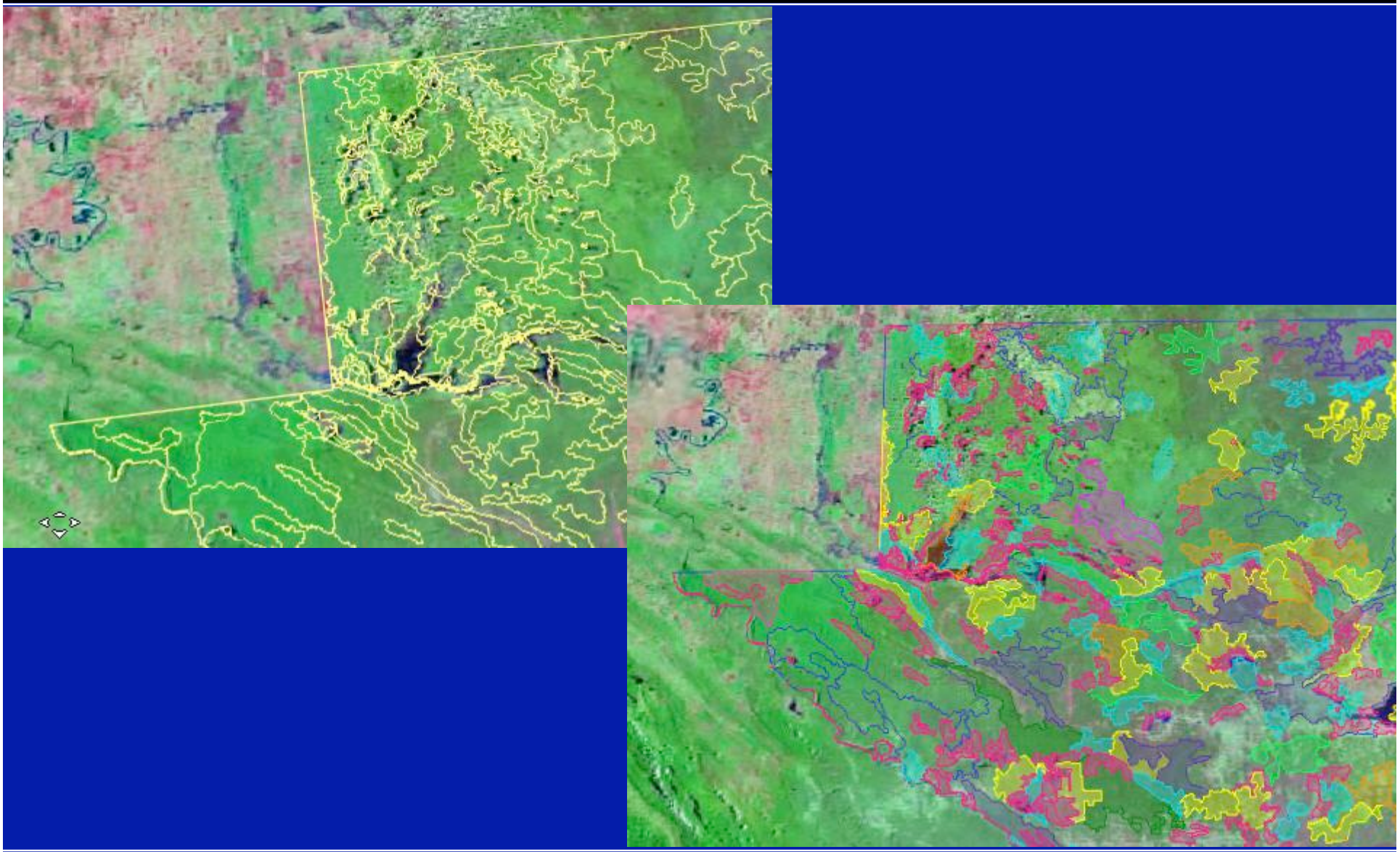


Landsat 15 Meter Resolution Mosaic - Examples

IKONOS Data Over Landsat 15 Meter Imagery

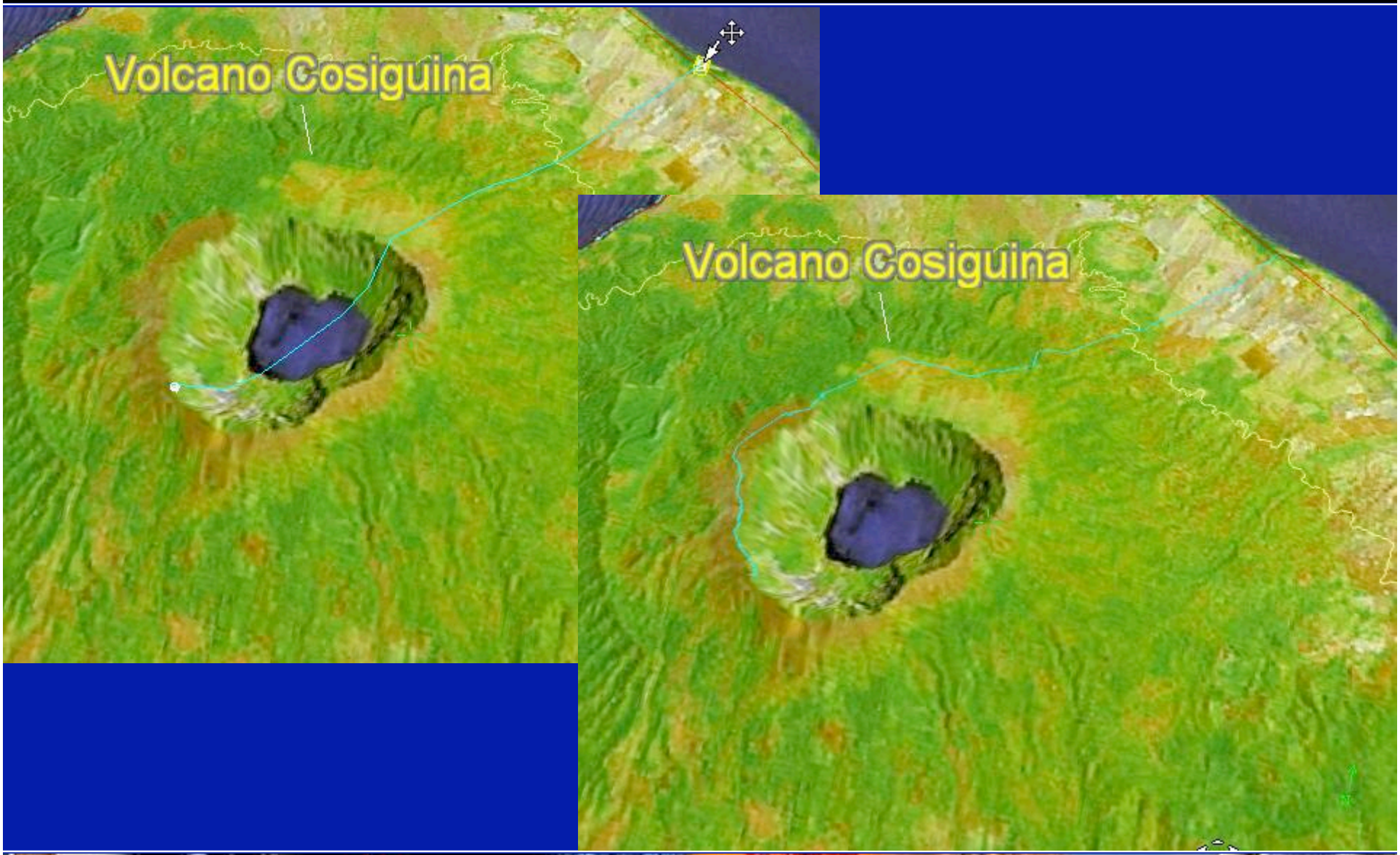


Vector Data Over Landsat and SRTM Elevation

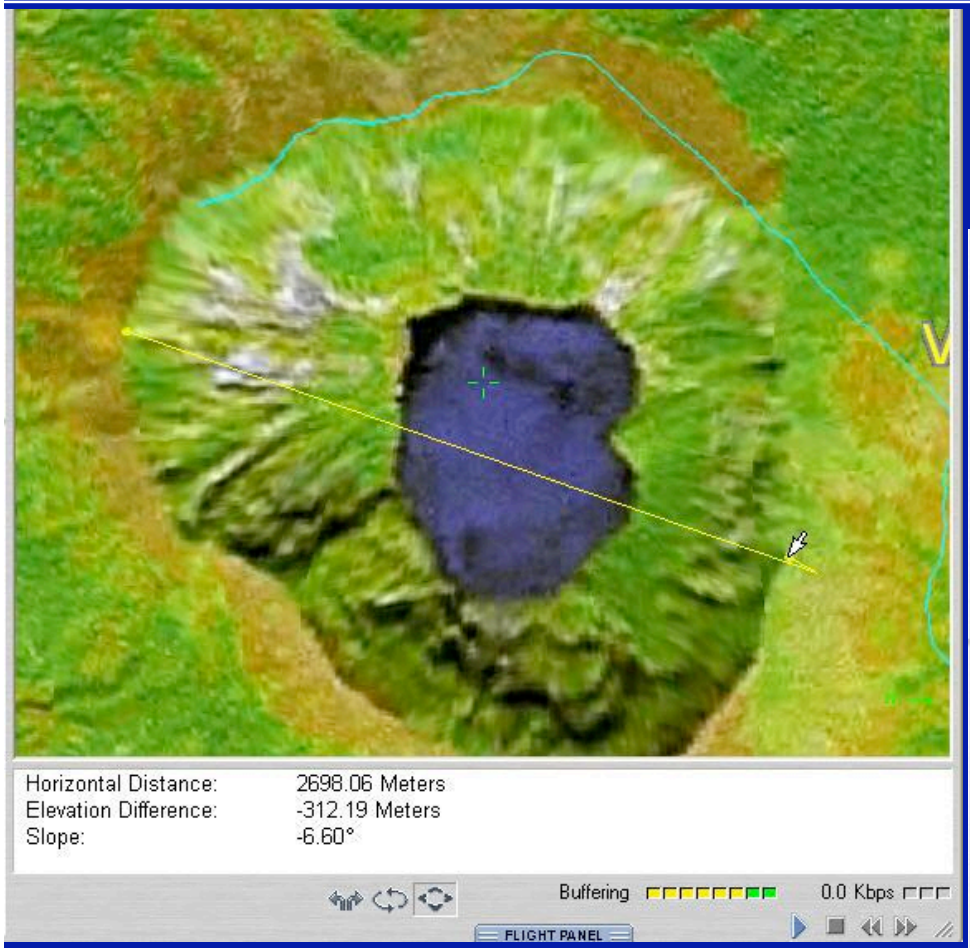


3-D Flyover of Volcano Cosiguina - Guatemala

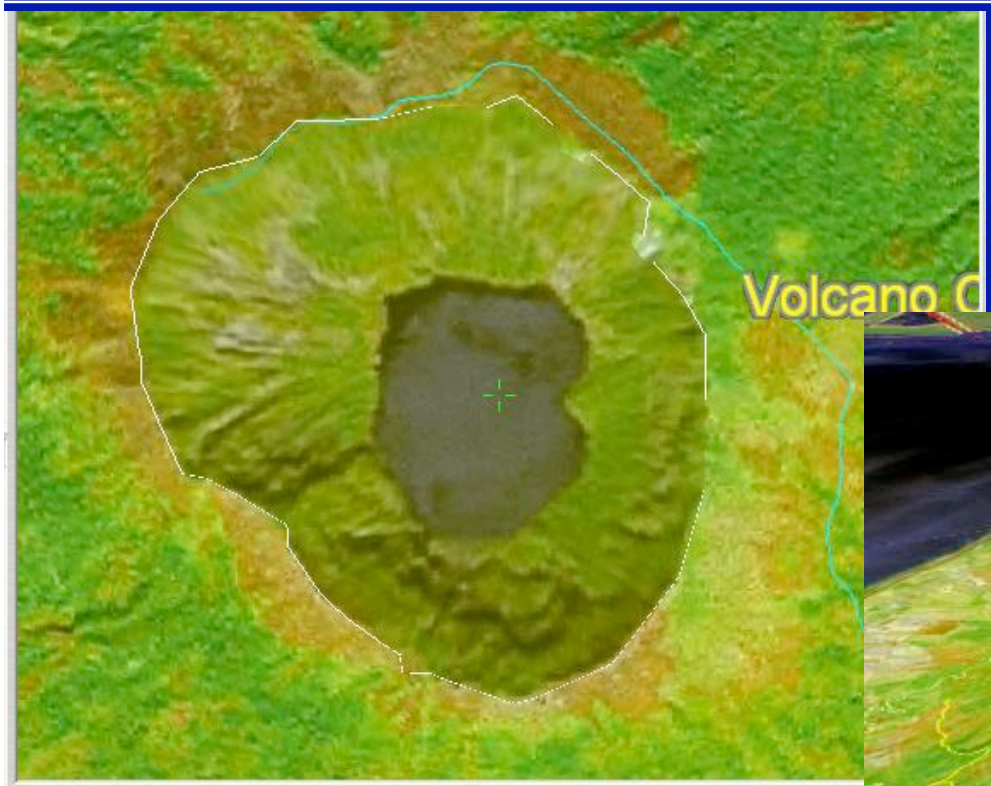
TEP Tools: Calculation of Best Path

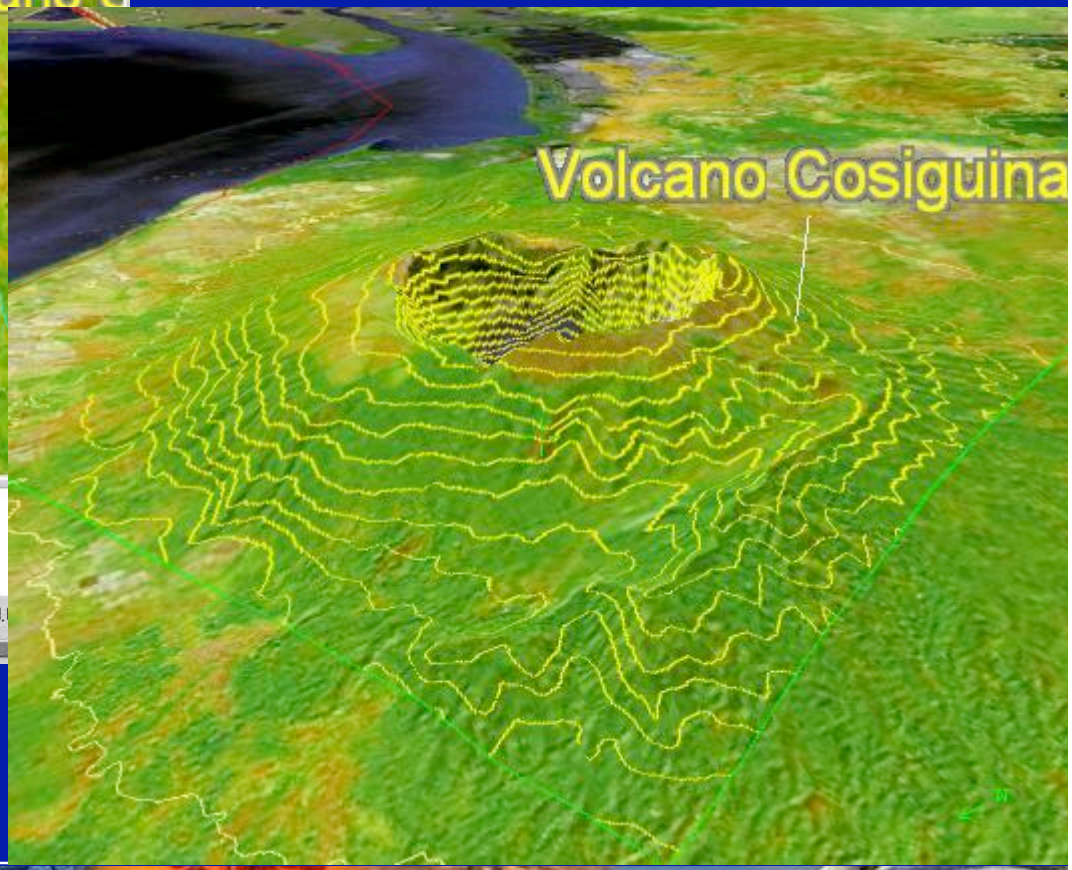


TEP Tools: Distance Measurement

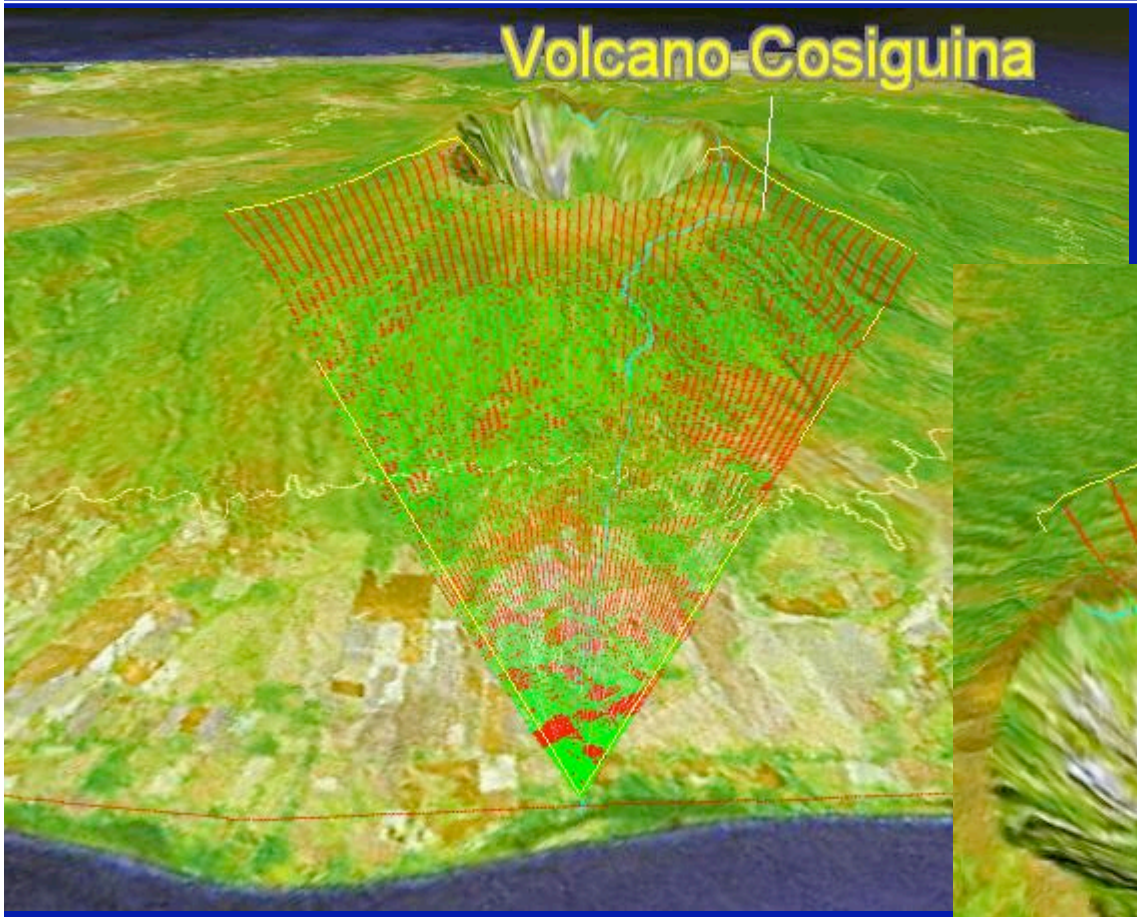


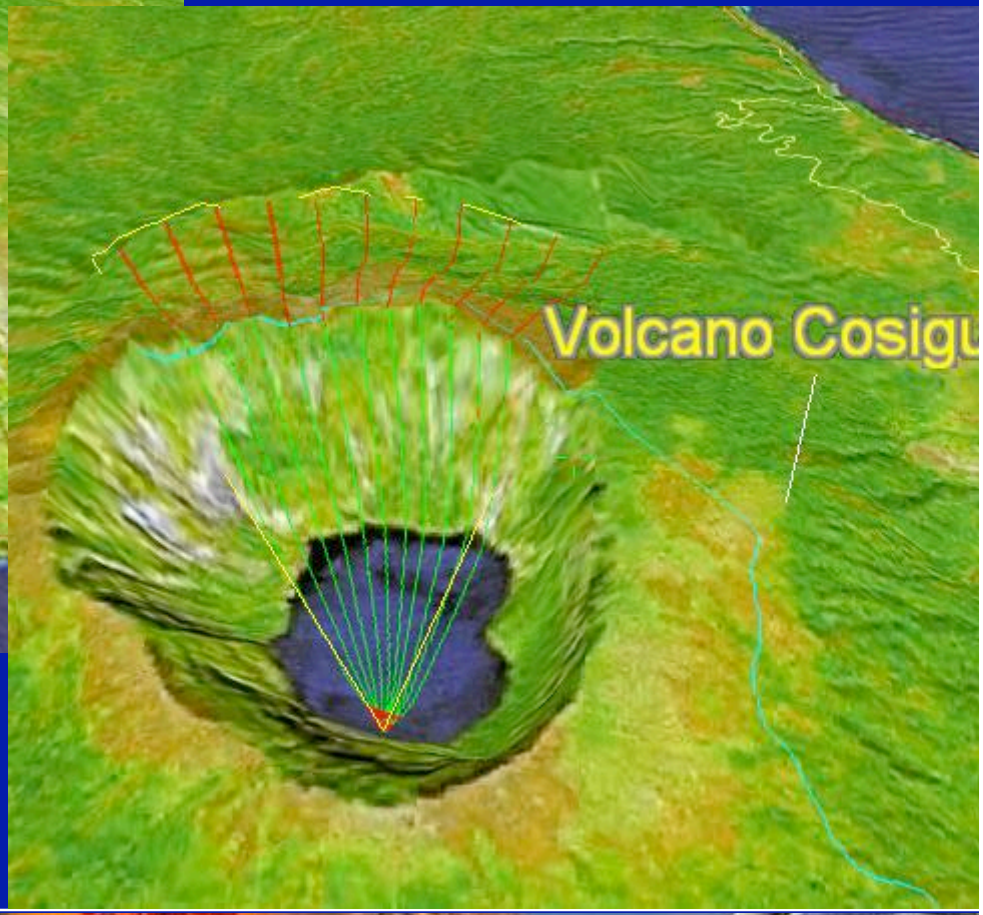
TEP Tools: Area and Contours



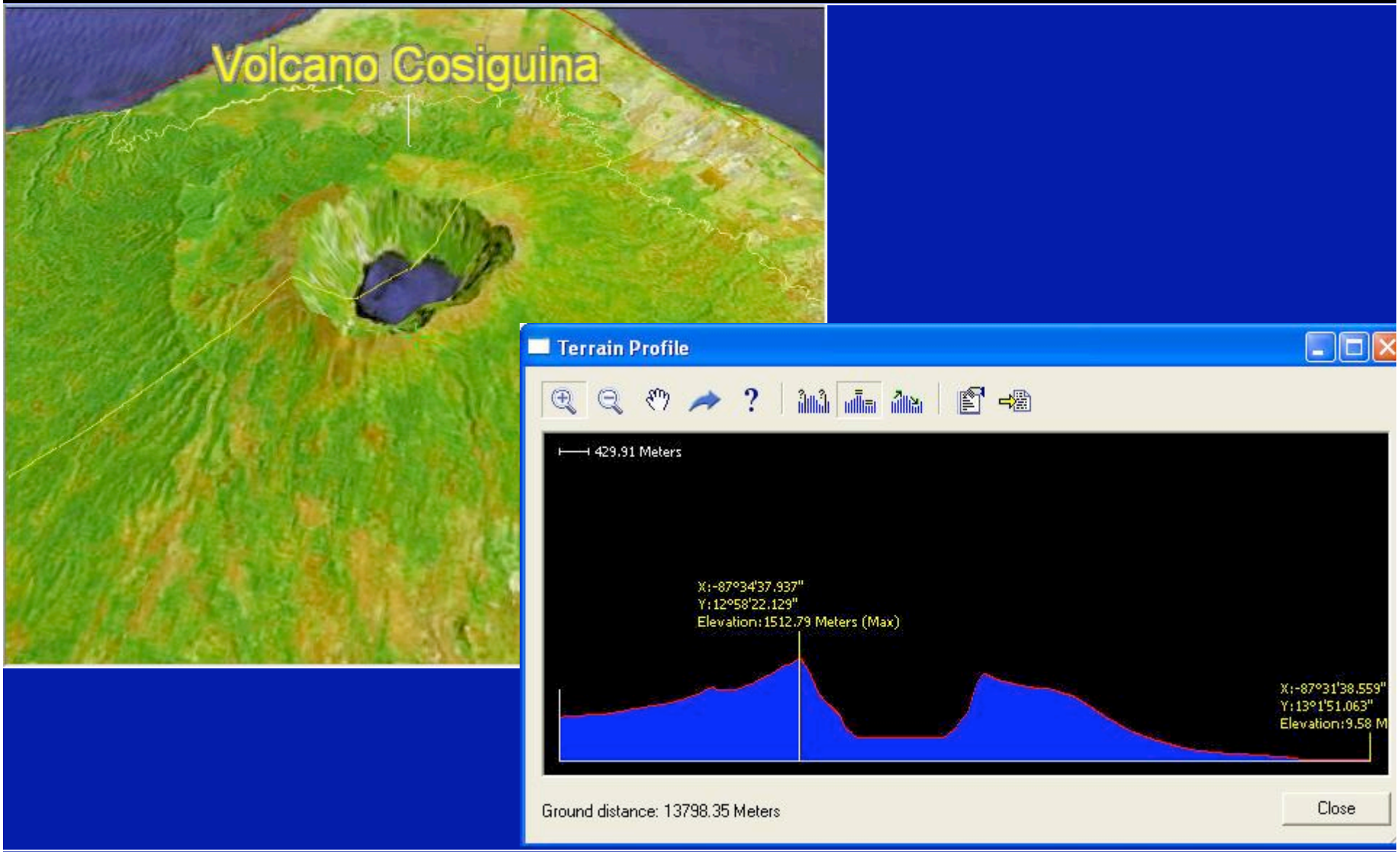


TEP Tools: Viewshed Analysis





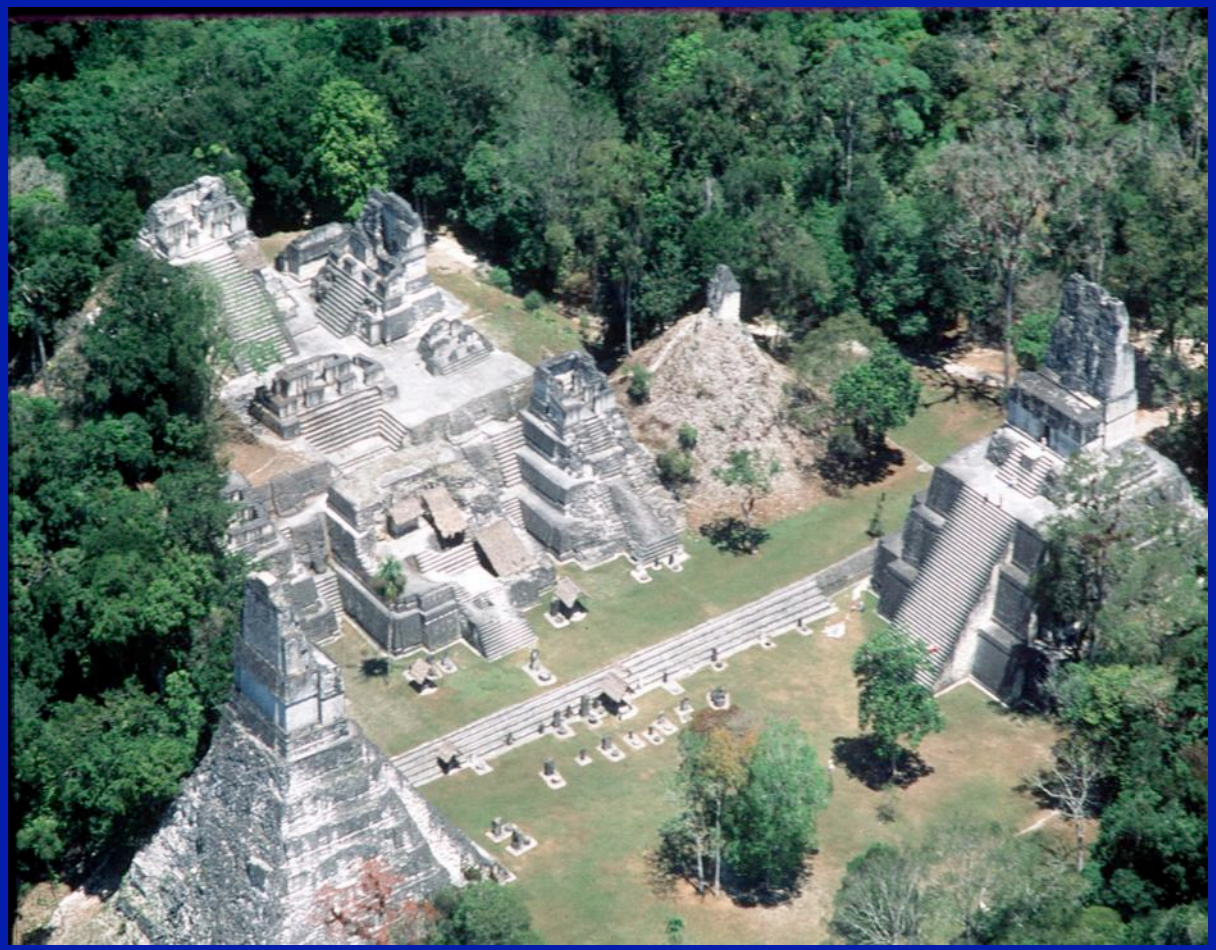
TEP Tools: Terrain Profile

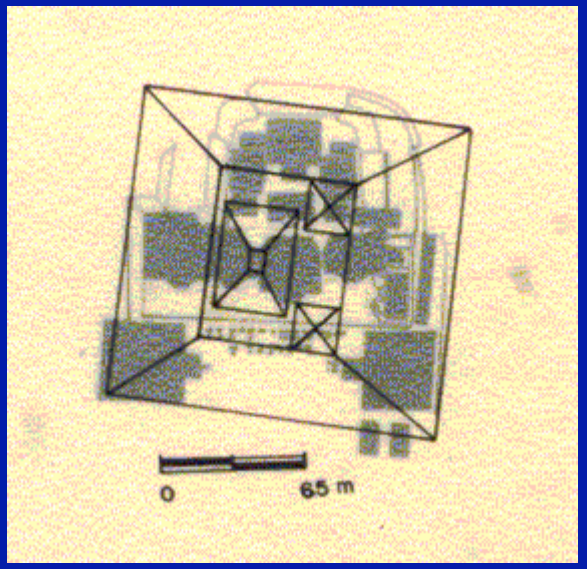


Accomplishments to Date

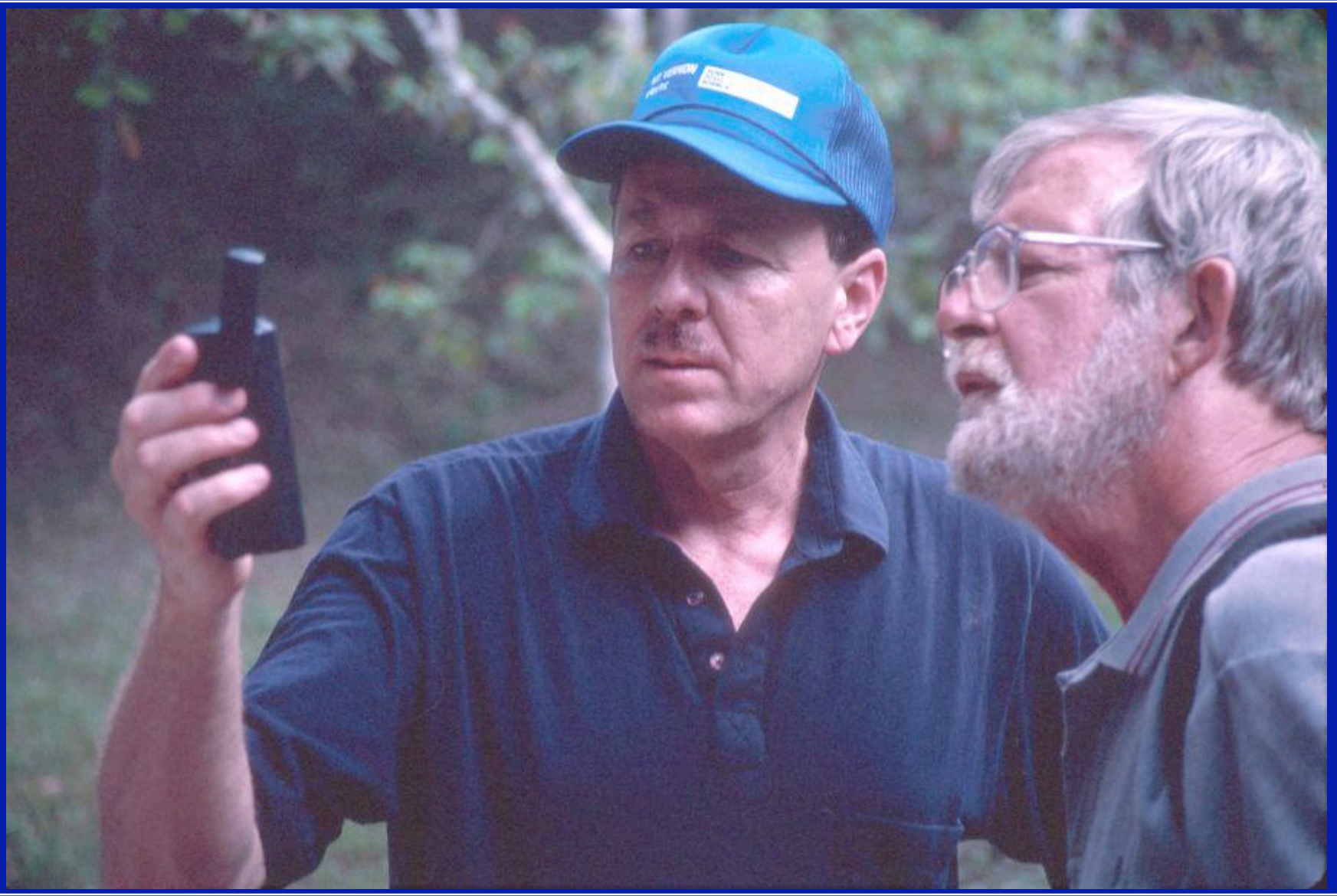
- **Development of NSSTC SERVIR Node**
- **Interactive Web Site Online – One Stop Shop for Data, Interactive Maps, Decision Support, and Visualization (Fully Operational – February 2005)**
- **Fires Products Operational**
- **Red Tides Products Operational**
- **First Regional Climate Modeling Workshop Ever Held in Mesoamerica**
- **Response Mode Flood Analysis in Panama**
- **Visualization Products for Central America**
- **Visualization Workshops at NASA/MSFC**
- **Data Distribution System for Panama Built and Operating**
- **CATHALAC - Staff Hired**
- **Integration of Inter-American Biodiversity Network (IABIN)**
- **Regional Node Facility and Training Center Operating**
- **Integrating other Research at NSSTC**

Archeology from Space

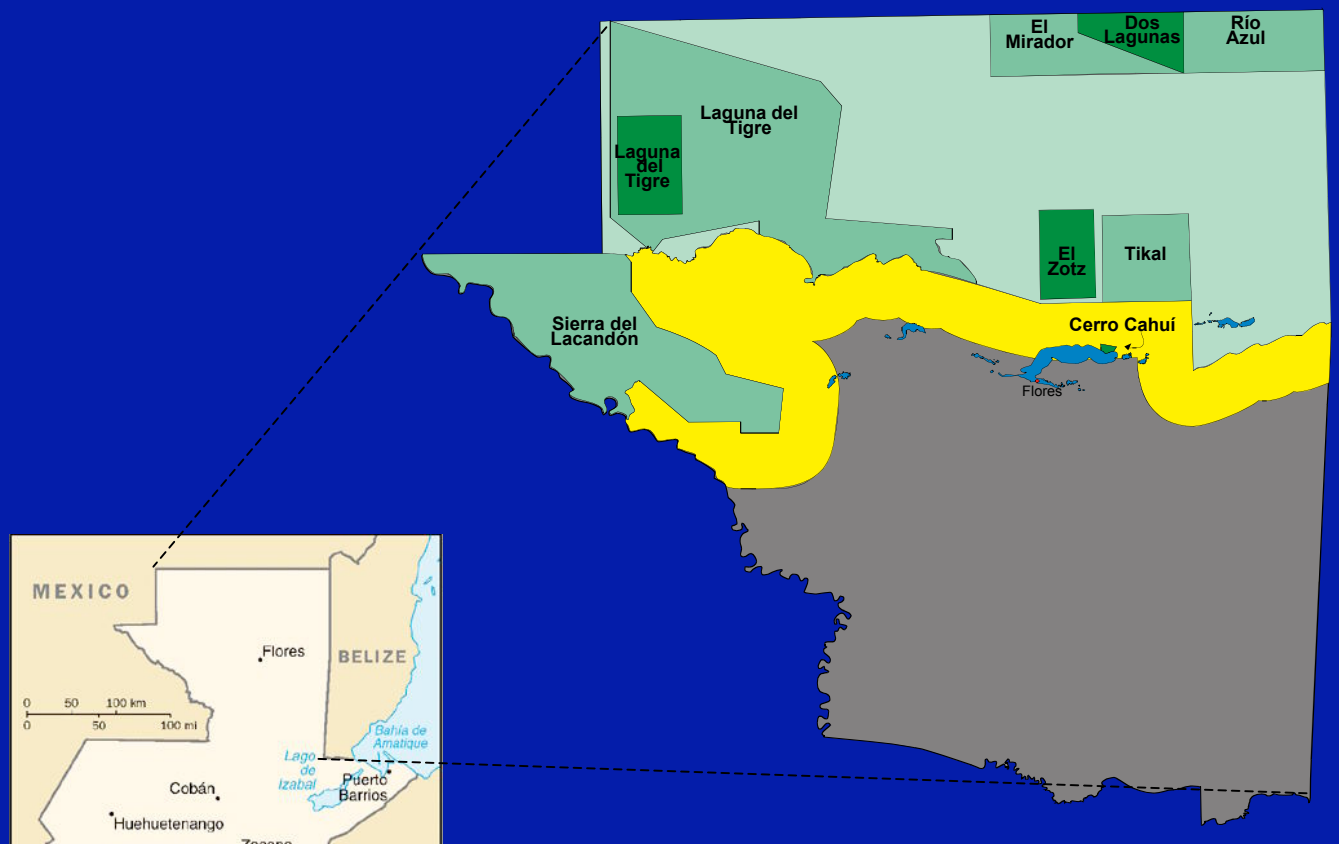




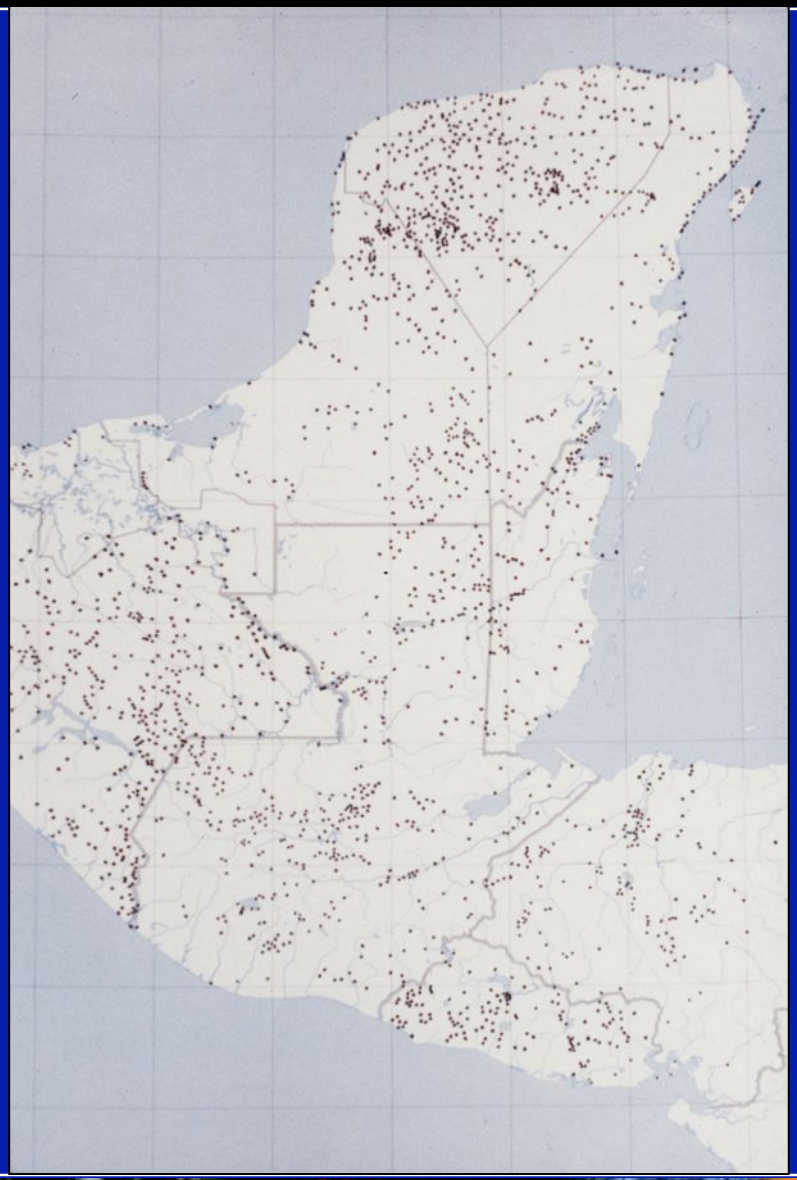
Dr. Tom Sever – NASA's Archeologist

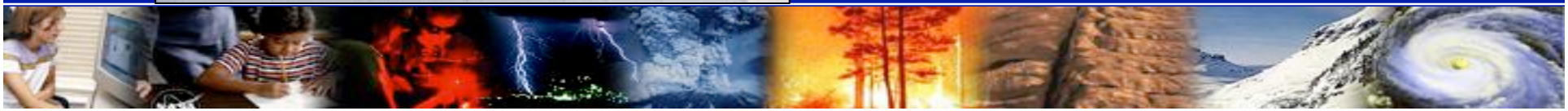


The Maya Biosphere Reserve

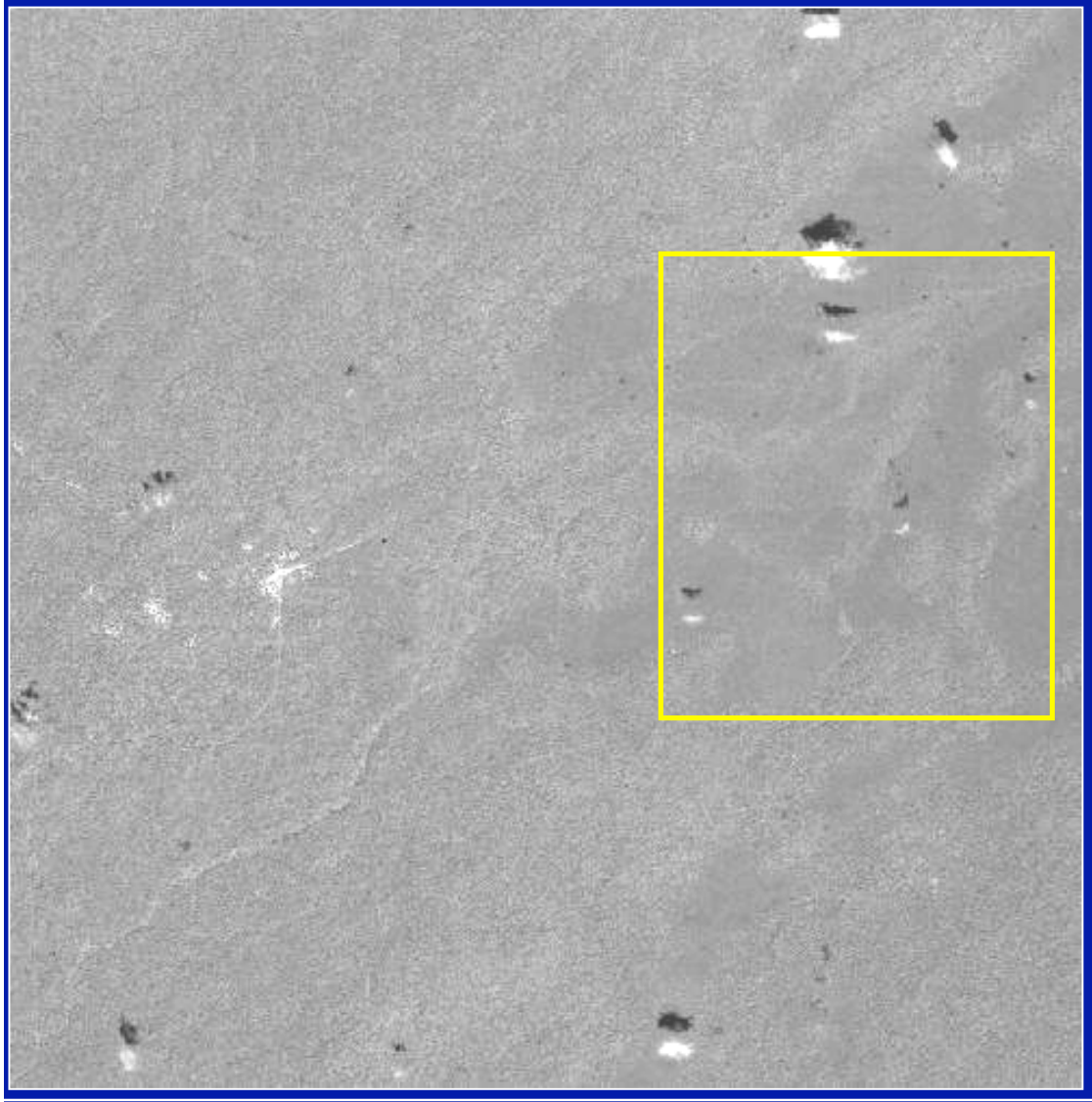


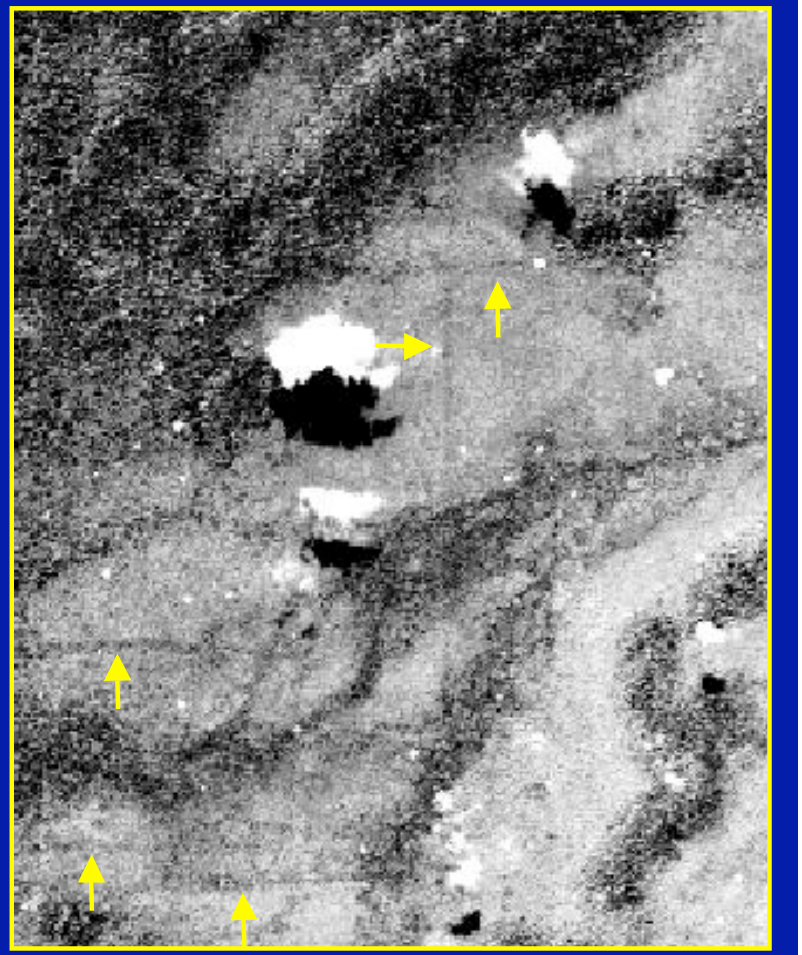
Ancient Maya Cities



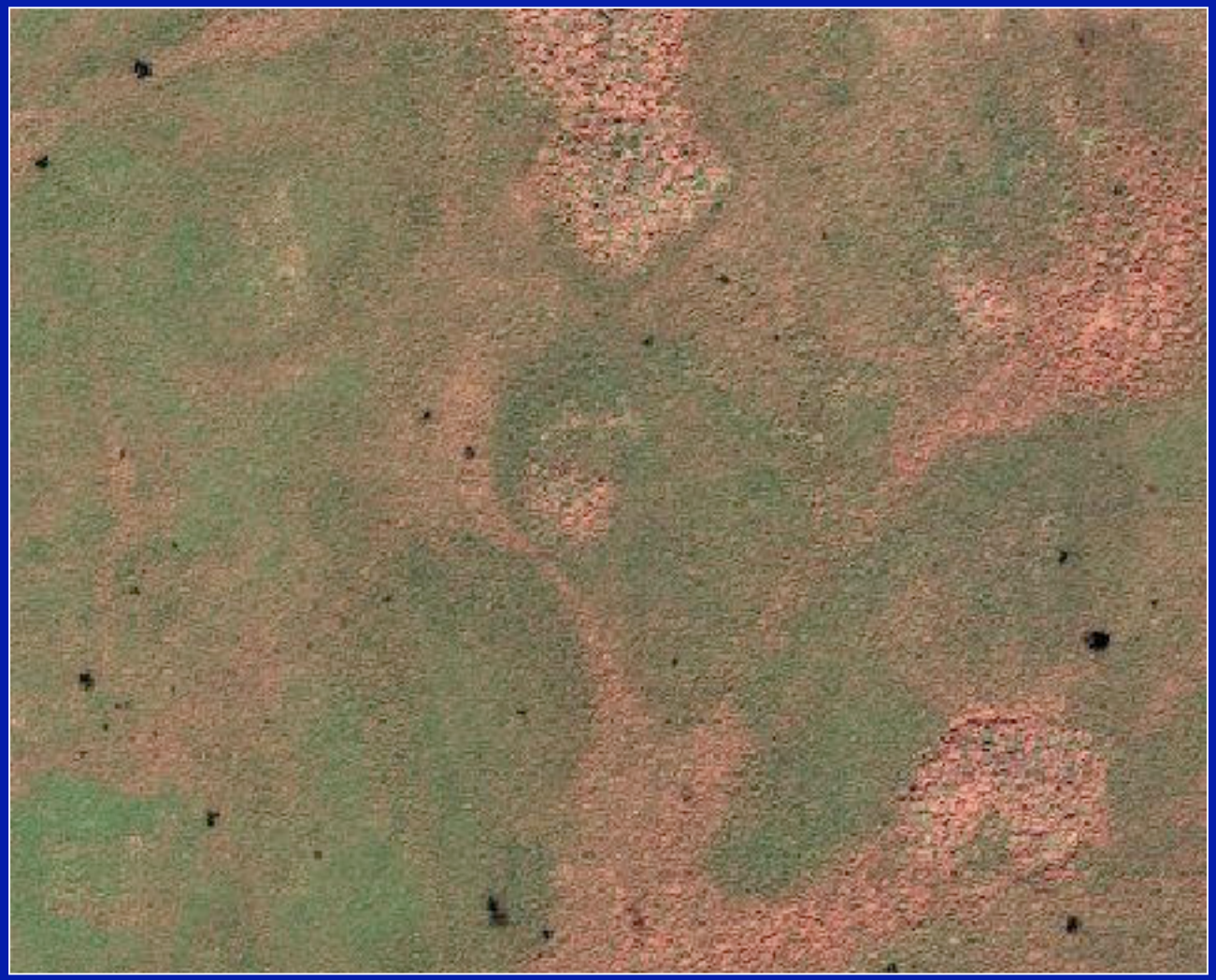


Ikonos Data – Linear Features

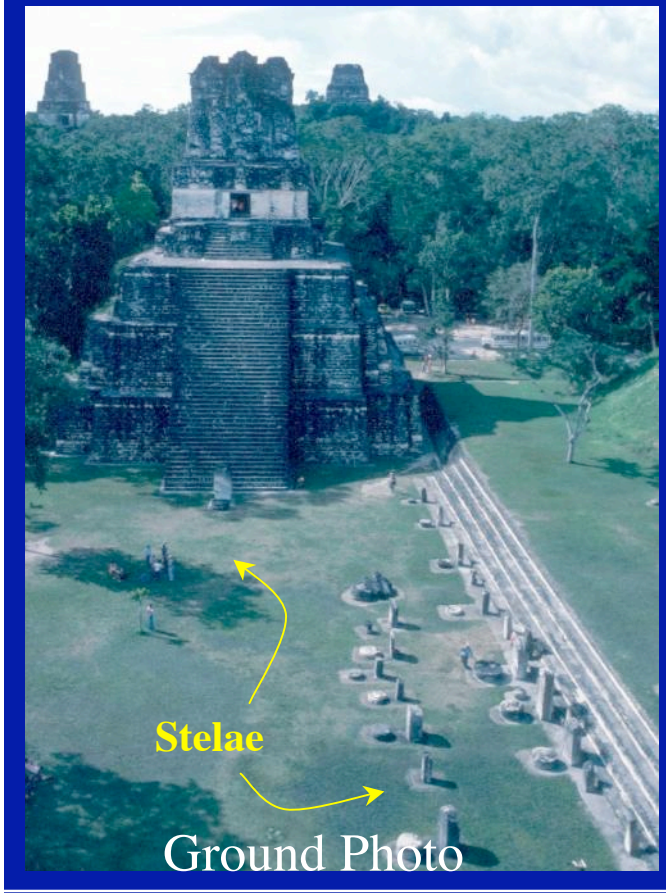




Ikonos Data - Aguadas



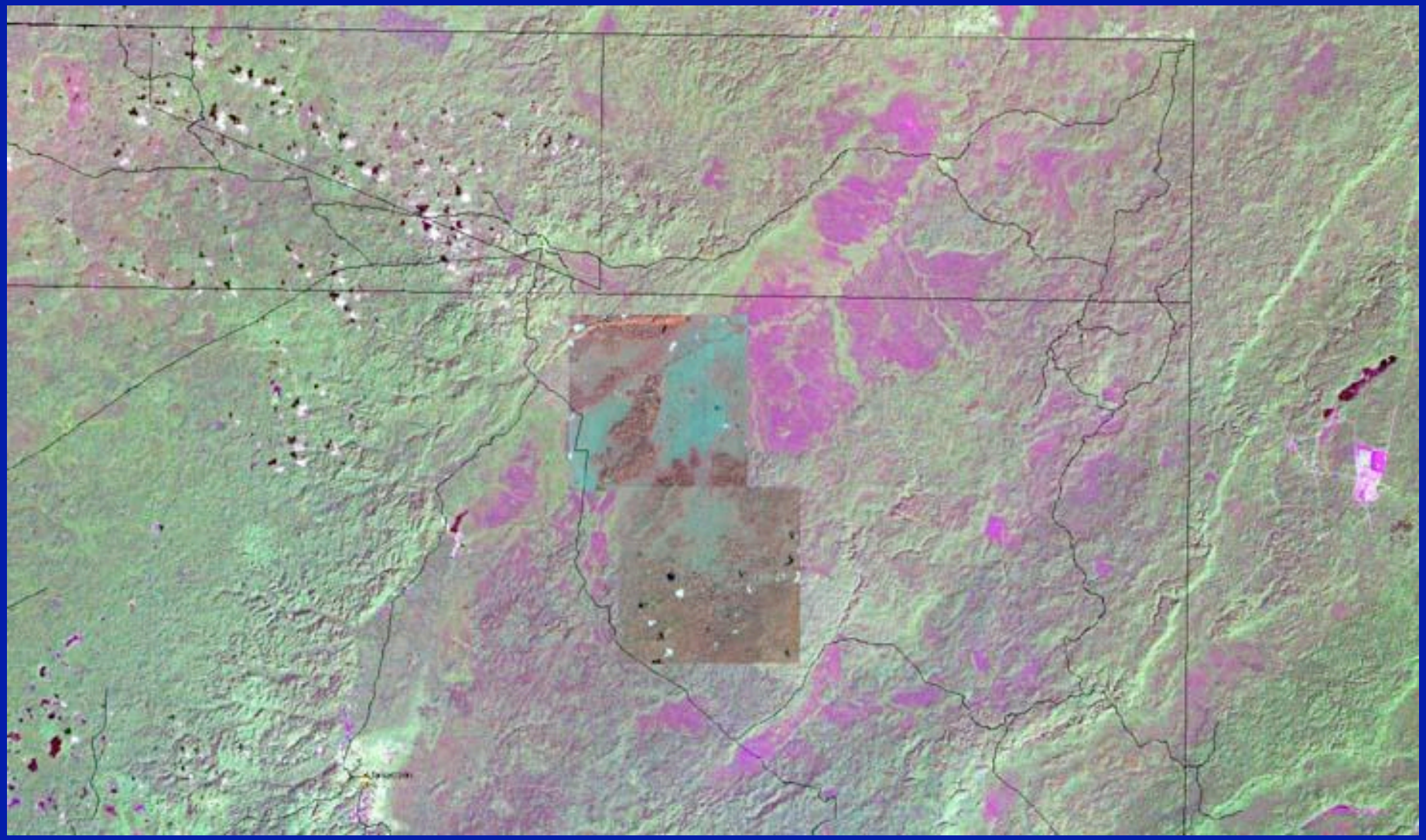
Capability of IKONOS Satellite Imagery to Detect Small Features Such as Maya Stelae at Tikal National Park, Guatemala



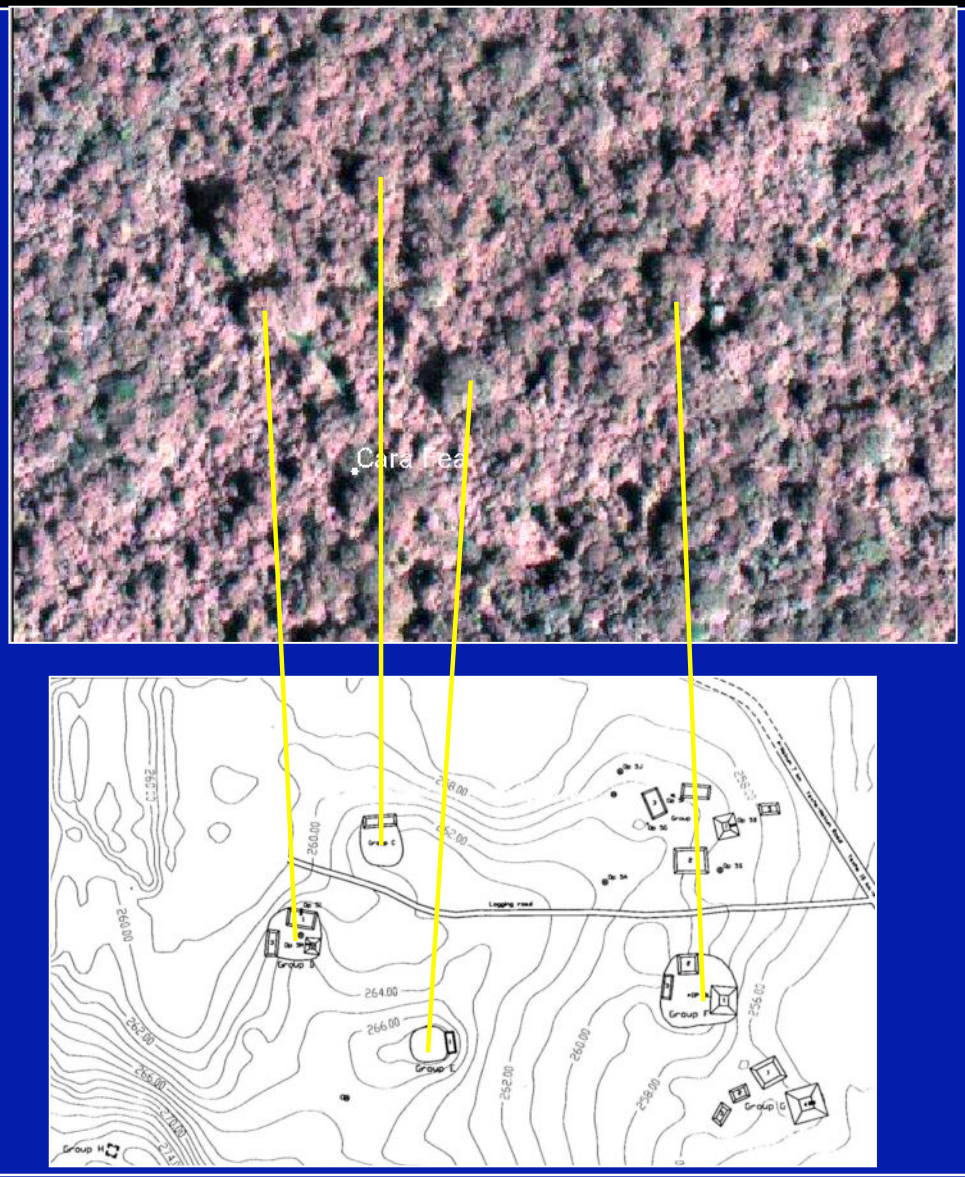
Full IKONOS Scene
11km x 11 km

Tom Sever and Dan Irwin
Marshall Space Flight Center

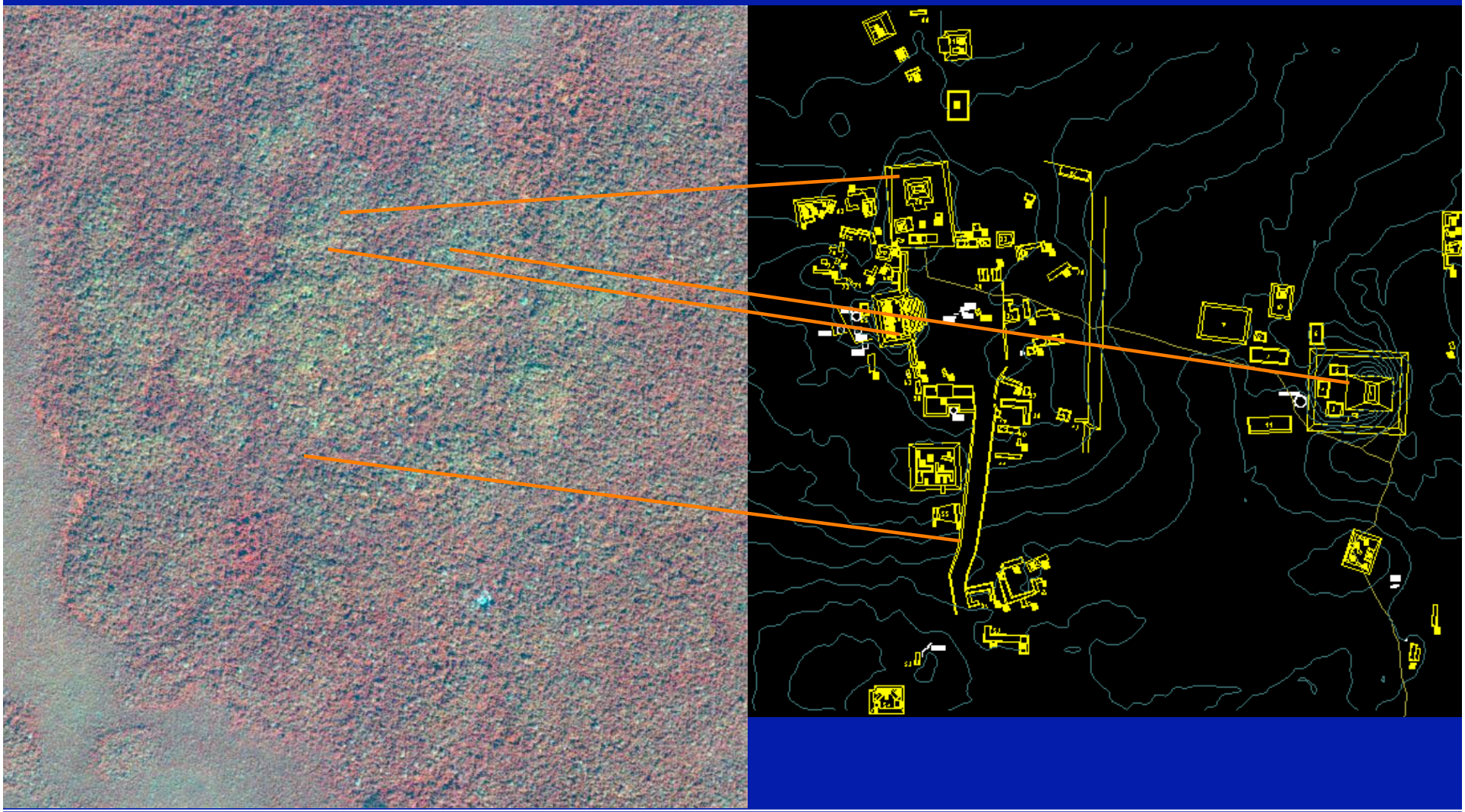
IKONOS overlay on Landsat

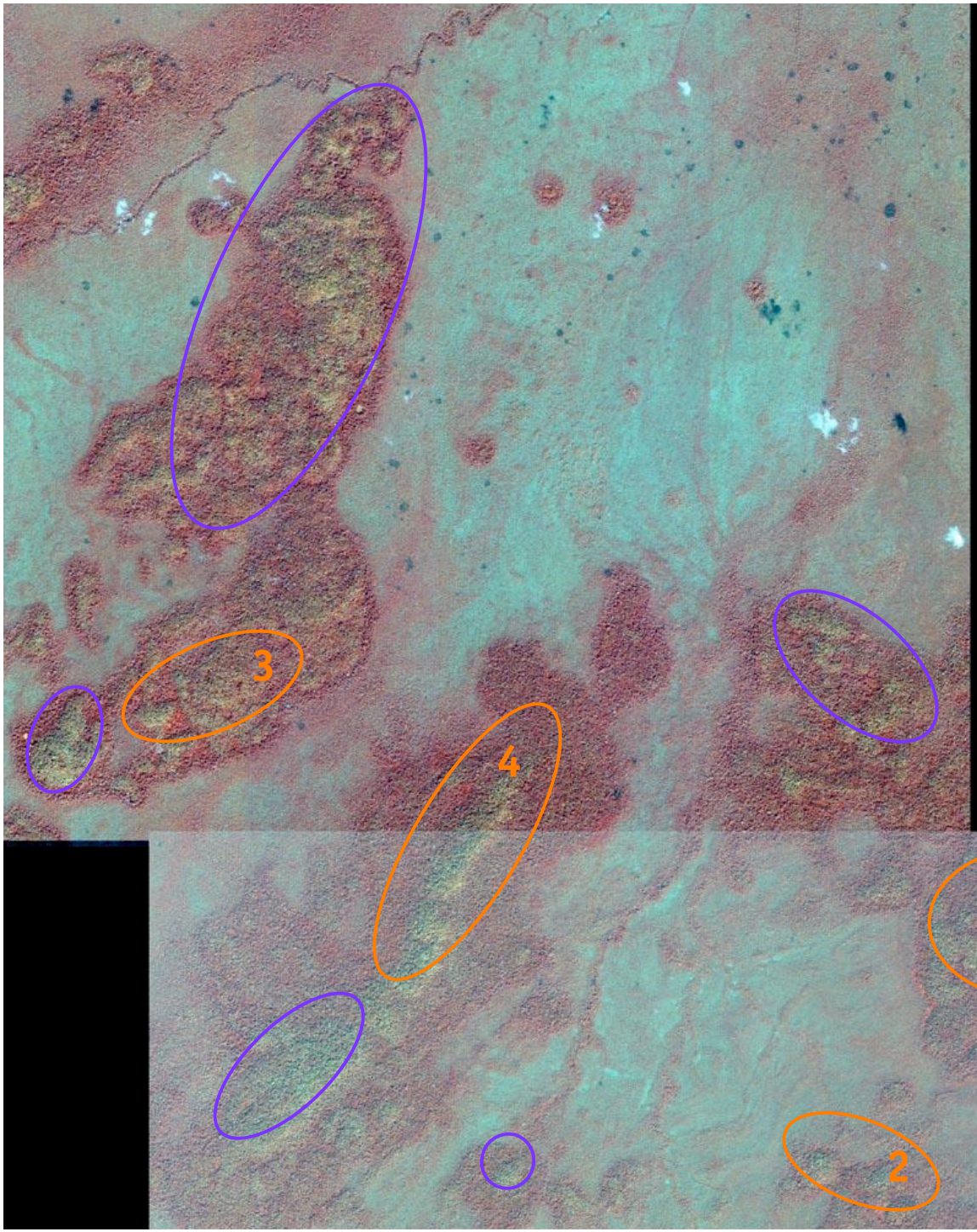


Mayan Architectures Detected via Remote Sensing



Mayan Ruins at San Bartolo



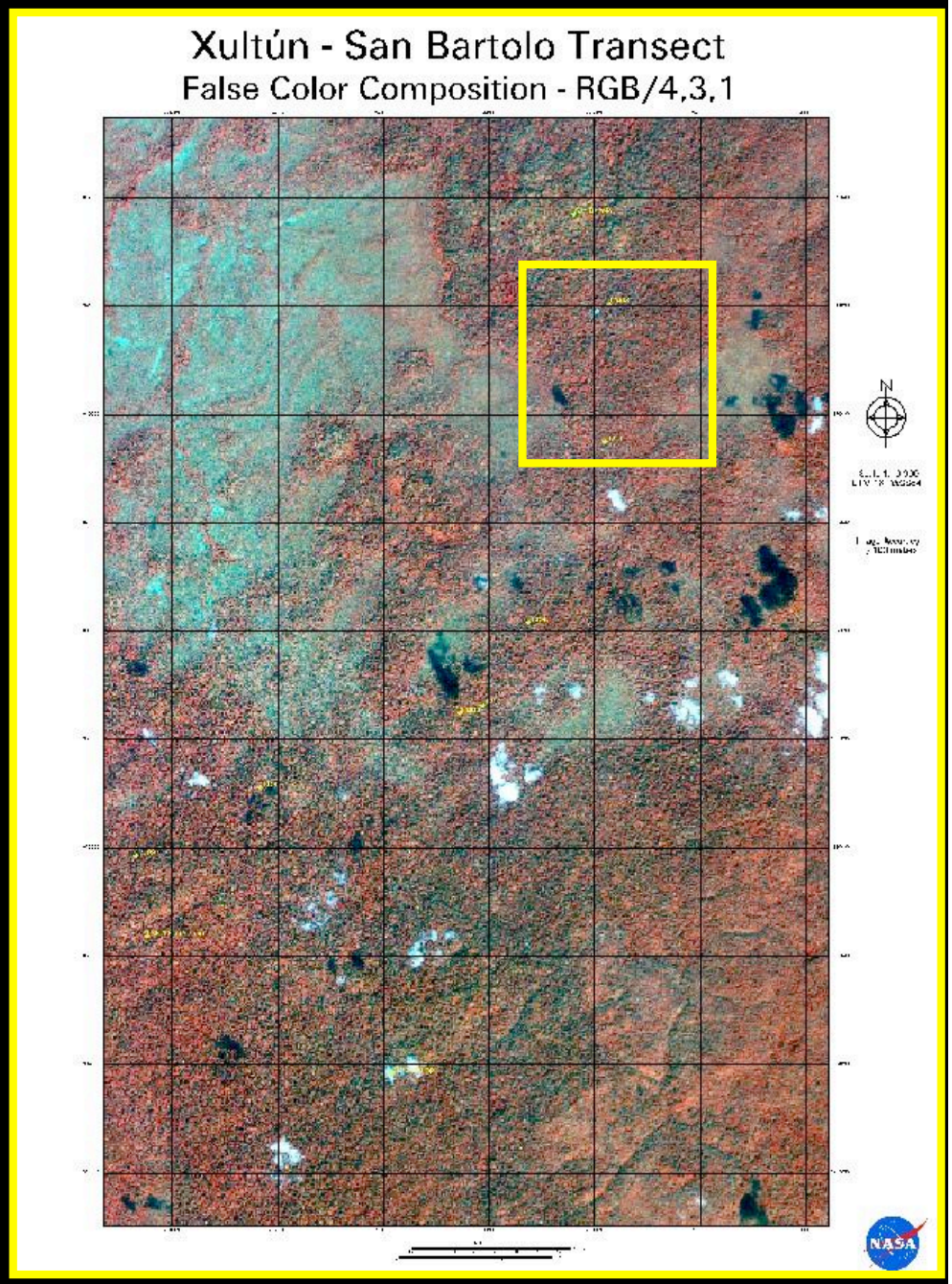


Isla Oásis and the Area Northwest of San Bartolo

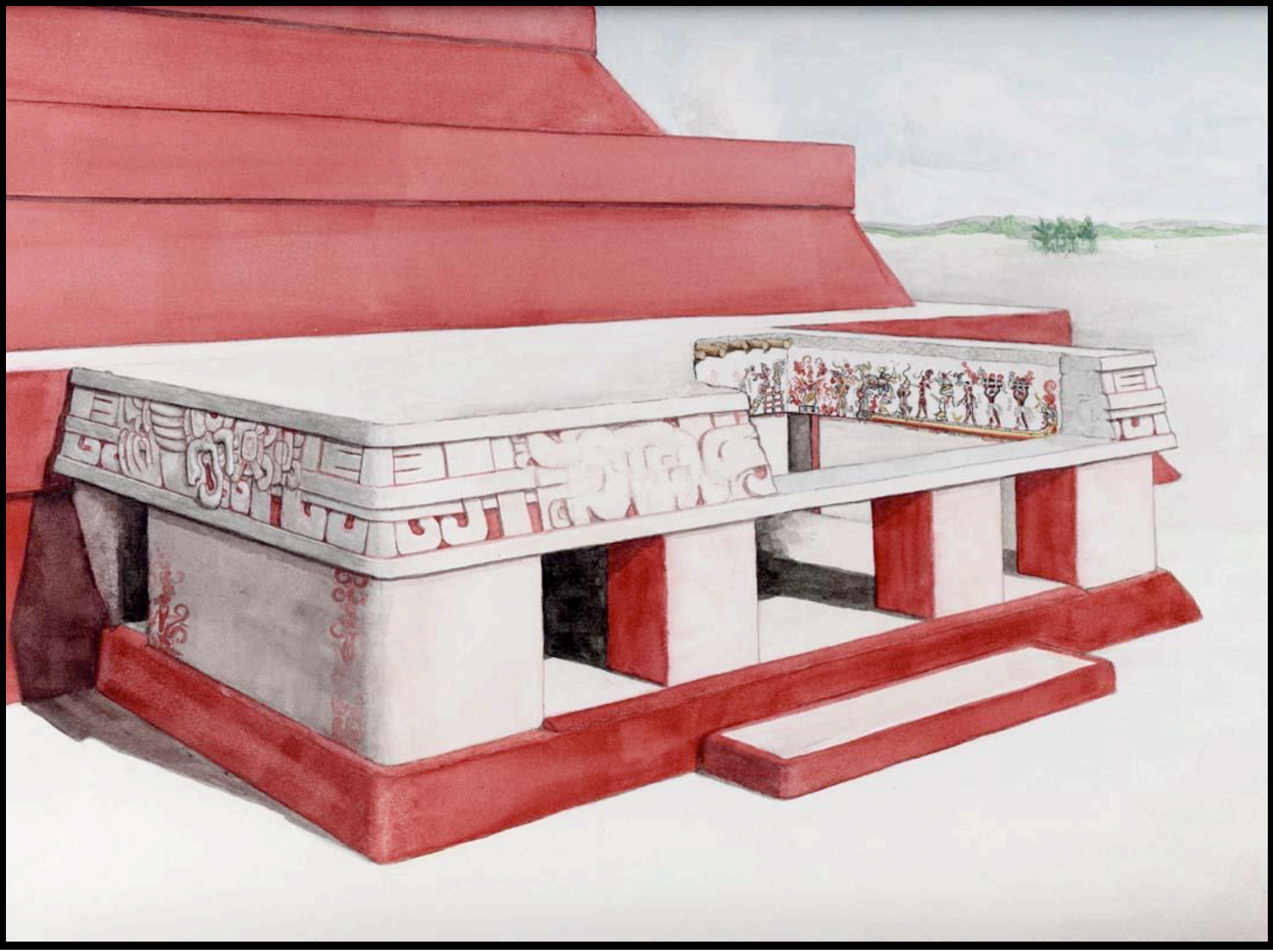
1. San Bartolo
2. Chaj K'ek' Cue
3. La Prueba
4. Las Minas

• Sites Identified on the Satellite Imagery, but Not Yet Verified on the Ground

Dr. Bill Saturno



Artist's Sketch of Mural and Temple 200 BCE



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